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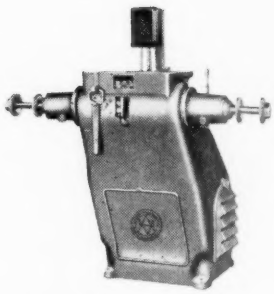

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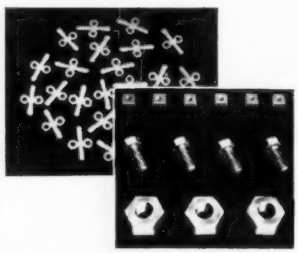

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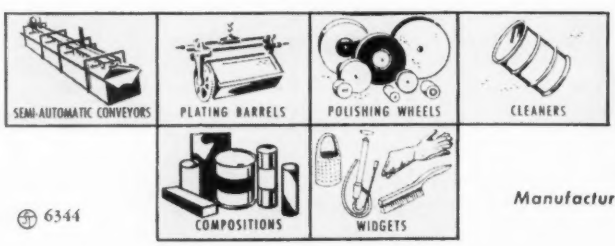

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METAL FINISHING

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Metal Cleaning's "One World"

On a previous editorial page (*February 1950*) we commented on the fact that alkaline cleaning of metals, without doubt one of the most critical operations in successful commercial electroplating, is still being conducted more or less as an art, rather than as a precise chemical operation, due primarily to the lack of an adequate test method for evaluating cleaning results and cleaning baths. We would now venture a step further with a suggestion for a different, but more fundamental approach to the development of an adequate cleaning test.

Investigators are at least unanimous in their agreement that one of the biggest stumbling blocks in the way of developing a suitable cleaning test lies in the uncertainty of the nature of the foreign matter that must be removed in the cleaning operation. Correlation of laboratory and production line results is thus made extremely difficult, and correlation between various investigators made almost hopeless.

This fact, it seems, should offer the clue to the whole problem. Why not develop first a "standard soil" for use in this work? In other fields of testing we have synthetic sea water and (you should pardon the expression) synthetic perspiration, as well as many other synthetic testing standards. If it accomplishes nothing else, it at least puts each cleaning investigation on a common starting basis, which is where no two metal cleaning investigators are presently in agreement.

It should not be too difficult to compound such a "standard soil". The list of materials that make up the bulk of the industrial soils encountered in alkaline cleaning is not too long; mineral oils and waxes, saponifiable animal or vegetable matter, stearic acid, tallow, various abrasives, inert materials, and metallic particles would all have to be included, but there are not too many more. Component materials should preferably be ones that could be quantitatively separated, or measured, apart from the others, in order that any residual soil remaining after a cleaning test could be identified, and also so that the method of evaluation need not be restricted to the usual before and after weighing type of test. It would also be necessary to have a standard soil that could be 100% removed by one means or another, so that any attack on the base metal could be measured.

Development of such a standard soil would make an interesting and highly important research project. Once developed, it would make possible an accurate evaluation of the many other factors involved in the actual cleaning operation. Most important, however, would be the fact that everyone would be talking the same language, as contrasted to the present chaos where nobody's test means much to the next person.

Only by starting on common ground and talking the same language can we hope to elevate the alkaline cleaning step to a precisely understood and controlled operation.

W. A. Raymond

Electroforming—A Versatile, Precision Production Method

By Benjamin Melnitzky, *New York, N. Y.*

THE term "electroforming" is used loosely to designate several related electrodeposition methods. The plating of nickel 0.02" thick on the inside diameter of a mis-machined transmission gear is an impressive accomplishment, is an excellent means for salvaging the scrapped part, but is not electroforming. Plating on glass, ceramic, plastic, and other non-conductors is a useful technique, is a valuable production process, but, again, is not necessarily electroforming.

The term is employed correctly to designate electrodeposition used to fabricate completely metallic objects. As such, the process belongs in the same category with die casting, sand casting, precision casting, and other older fabrication methods. In fact, electroforming has been called "cold casting," and with good reason.

Simply stated, electroforming is a method for producing parts by the build-up of electrodeposited metal on the surface of a mold or matrix. Unlike electroplating, which has as its end purpose the formation of a permanent bond between the deposited metal and the object being plated, the goal of electroforming is the creation of a temporary bond. In fact, faulty electroplating first gave the clue that led to the new fabrication method. It was observed that when defective plating peeled, it carried with it a very detailed negative imprint of the surface to which it had been plated. The ability to produce a "detailed negative imprint," plus the ability to produce depositions as thick as one-half inch, are two major attributes of electroforming. There are also others, which will be detailed subsequently in this article.

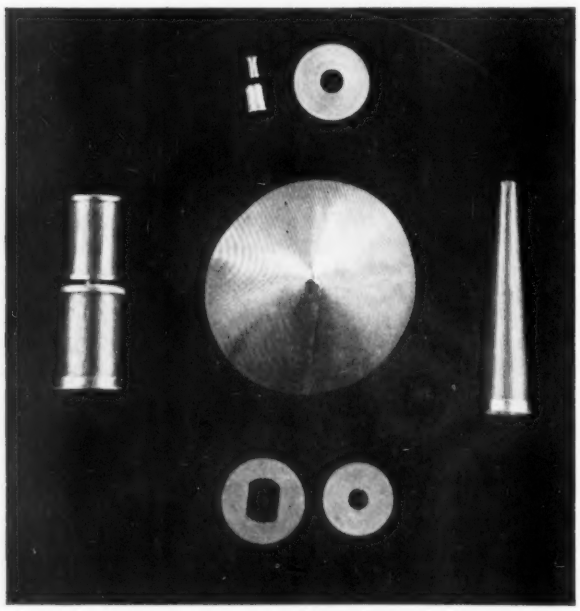


Fig. 1—Copper and nickel electroformed fine mesh precision screens.
Courtesy C. O. Jelliff Corp.

Electrotypes, used for so many years in the printing trades, represent the earliest electroforms. The invention of this process for making printing plates is generally credited to *Professor Jacobi*, a Russian inventor who collaborated with two Englishmen, *T. Spencer* and *C. J. Jordan*, to perfect the first electrotype in 1839. The original patent for this process was issued in 1840. Since that time more than 350 additional patents on electrotypes have been granted in the United States alone. The first American electrotype was electroformed in 1842 by *J. A. Adams*, a New York wood engraver. A few years later the process was utilized by Harper's Publishing Company to reproduce drawings in their edition of the Bible.

Production of seamless copper tubes and sheets is another early electroforming development.

It can be seen that electroforming (of copper and nickel, at any rate) has had a long and honorable past. However, producing iron parts by electrodeposition is an entirely different matter. Electroforming of this metal has had a brief but impressive history.

The process for electroforming iron was developed for the express purpose of making molds for automotive tires. As can readily be imagined, the complex and intricate designs of the tire mold present a difficult production task when conventional die-making processes are used. It was decided more than 13 years ago that the high cost of molds might be reduced if a new process, similar to that used in the phonograph industry, could be developed. However, forming record masters required only a thin shell of copper or nickel to be deposited on the original wax cutting, whereas for tire molds a shell measuring $\frac{1}{4}$" to $\frac{1}{2}$" thick would have to be built-up in the plating bath. Since copper does not lend itself to curing of rubber products, another metal was required. Iron was selected in spite of the fact that iron plating was not commercially feasible at that time. The process which made possible the electroforming of this metal

into thick tire molds was finally developed in 1938 and since then applied to a wide variety of parts to be made from iron.

Electroforming—and this includes the many patented processes now in use—has the unusual ability of being able to reproduce to the closest commercial tolerances the form of the matrix on which the metal is deposited. Dimensional tolerances of ± 0.0002" are possible. Electroformed precision wire screens such as those shown in Figure 1 are fabricated with individual strands 0.0008" wide. The precision of electroforming can further be gaged from the fact that foil measuring 0.00008" thick has been formed successfully.

In addition to fabricating to exceptionally close tolerances, electroforming can produce an exceedingly wide variety of shapes and sizes which can be manufactured by no other commercial method. Pen caps and fountain pen barrels with tapered, recessed, and other intricately shaped cross sections, as shown in Figure 2, are every-day examples of parts that can be mass produced economically by no other method. Other examples are legion. Radar "plumbing" developed during the war is a case in point. See Figure 3. (The term "plumbing" is used because the parts were designed to carry electromagnetic waves as a steam pipe carries steam.) Radar engineers, confronted with designing means for shunting these waves to various parts of the radar set, found that conventional wires were impractical because the electromagnetic waves could not be contained by the wire. Intricately shaped tubing was designed to carry the waves. However, having discovered the means of transportation, the problem of how to mass produce the various type of plumbing then presented itself. One of the most practical means was electroforming. Parts with exceptionally long tapers can be produced in one unit only by electroforming.

Even now, one of the major attributes of electroforming is the fact that frequently no alternate fabrication method is economically feasible. Precision casting can produce parts with intricate contours and with close dimensional tolerances, but only electroforming can produce such super-accurate parts as record masters.

The Matrix

The electroforming process evolves about the matrix onto which the metal is deposited. (Matrix is also referred to as mold, mandrel, pattern, core, former, impression, mat, and other such terms.) The matrix controls to a considerable degree the dimensional accuracy, shape, internal surface, and cost of the finished article. The electrolytic bath, the equipment used, even the techniques followed do not differ radically from conventional electrodeposition; the matrix, however, is the one major element that differentiates electroforming from all other related methods.

There are in use a wide variety of matrices including metals and non-metals; electrical conductors and non-conductors; permanent, semi-permanent, or expendable. Some matrices are die-cast while others are machined, hobbed, press-formed, or fabricated by one of many other methods. The one common denominator is the fact that, in one way or another, the matrix must be separated from the metal shell formed about it. The separation factor necessitates the use of parting compounds and other means for preventing fusion of deposited metal and the underlying matrix.

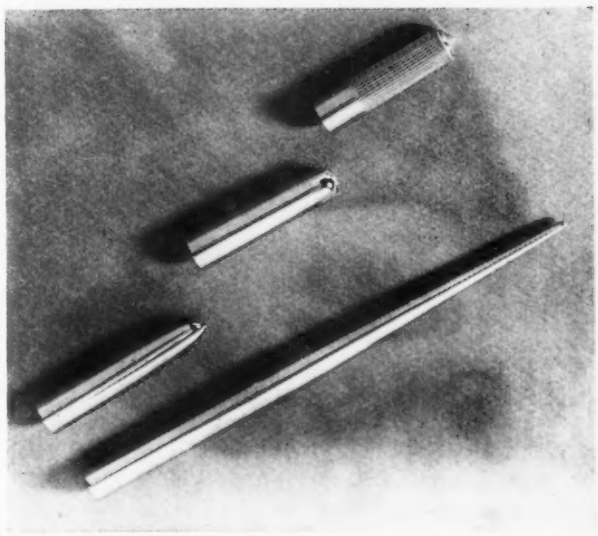


Fig. 2—New design for pen caps made possible by electroforming with nickel.

Courtesy Camin Laboratories, N. Y.

The simplest are the permanent or semi-permanent matrices that can be pulled away from the formed shell, by the application of tension, by prying with sharp knives, or by heating. The last-mentioned method is used where differences in coefficient of thermal expansion exist between mandrel or matrix and the formed article. Where low-cost, mass-produced shapes with simple designs are being fabricated, a permanent mandrel made from alloy steel, brass, nickel, stainless steel, or other durable metal is used. As can readily be visualized, the surface of the formed article will be determined by the nature of the mandrel surface. Thus, the mirror surface of the reflector parts shown in Figure 4 resulted from forming on a highly polished steel mandrel. The same finish might be obtained by using a glass mandrel whose superior surface will be imparted to the electroformed part. Articles that are rectangular, curved, fluted, flat, or any other shape which permits the mandrel to be pulled away from the formed shell may be manufactured by use of permanent or semi-permanent mandrels. For some parts, several mandrels may be used and interlocked so that each can be drawn out separately. Where there is less need for dimensional accuracy and where cost considerations are of great importance, mandrels may be made of wood, plaster, or other semi-permanent materials.

It is fairly obvious that when parts such as those shown in Figure 5 are to be produced, it would be virtually impossible to withdraw the matrix after the metal shell has been formed. For those and other parts with undercuts and other surface irregularities, an expendable matrix must be used. Any material that can be melted at comparatively low temperatures may be used. Fusible metal alloys, wax, and other low-

melting-point materials are fabricated as matrices by die-casting and other economic means. The matrix is then placed in an electrolytic bath and a shell of metal deposited on it. The formed part is freed from the matrix by the simple expedient of heating the part till the matrix material melts away. A matrix made of bismuth-lead eutectic alloy has a melting point of 200° F. When it is placed in a bath of hot oil whose temperature is in the neighborhood of 600° F., it takes but a short time for the formed part to be freed from its metallic matrix. The metal is recovered and subsequently reused.

Wax matrices containing 14 parts beeswax, 2 parts Venice turpentine, and 1 part graphite are employed for similar applications. Another wax composition used for electroforming applications contains 5 parts beeswax, 1 part Carnauba, 1 part Venice turpentine, and 1 part graphite. Mixtures of gelatin and glycerine treated with tanning so as to make them insoluble in the electrolytic bath have also found wide use.

Tolerances of ± 0.001 have been obtained from the expendable matrices mentioned here; however, if closer tolerances are desired, or if expendable matrices are for one reason or another undesirable, use is made of aluminum, magnesium, or zinc matrices which can be dissolved by acid or alkali, or electrochemically. Needless to say, the cost of this method limits its use to the fabrication of high-precision, high-cost articles which can not be electroformed on permanent mandrels.

A fourth method consists of using for the matrix alligator skin, fine grained leather (see Fig. 6), or any other "natural" material whose design or texture is to be transferred to metal by electroforming. Thus, a strip of alligator skin, suitably prepared, is placed in the bath and metal deposited on its surface. When separated, the formed metal becomes a true negative of the skin and can be mounted and used as a die

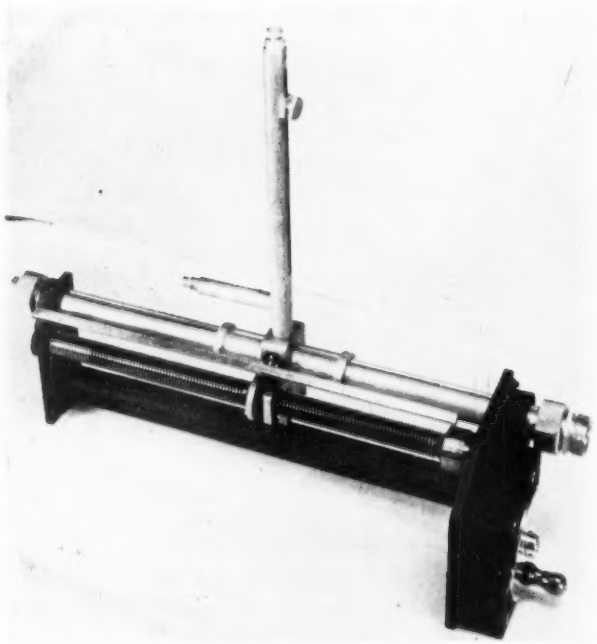


Fig. 3—Microwave (radar) test instrument requiring extreme accuracy of the tube bores. These tubes were fabricated by electroforming over a precision ground and polished mandrel.

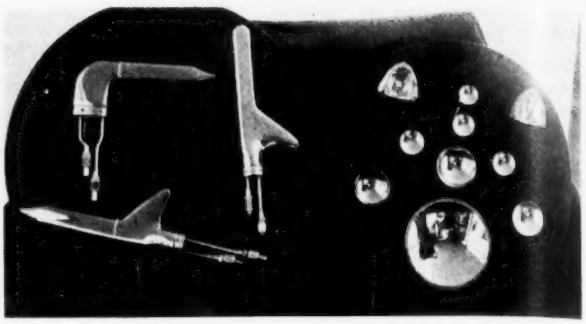


Fig. 4—(left) Electroformed pitot static tubes deposited around an internal form which is subsequently removed. (right) Electroformed mirrors and dentures. Mirrors are copper-nickel, dentures are of palladium.

(Courtesy of Kollsman Inst. Div. of Square D Co. and Bart Labs., Belleville, N. J.)

to stamp an alligator skin design on plastic or other materials. A similar technique entails the use of aluminum or zinc foil which is pressed flat against the article to be reproduced and then used as the matrix in the electroforming operation. Gutta percha mixed with lard or some other oil is used in a similar manner. The gutta percha is poured over the object and forms a precise cast which then serves as the matrix.

Parting Methods

The problem of insuring a temporary bond between matrix and formed shell is solved by the use of any one of several parting compounds and materials. These include: carbon black, beeswax, lacquer, rubber, bronze powders, graphite, cellulose, and many others. In a few instances, for example where molds are stainless steel, the parting compound can be eliminated. Separation, in such cases, is effected by physical pressure or the application of heat. For other metallic matrices the parting compound serves the obvious function of permitting withdrawal of the matrix by preventing adhesion between it and the formed shell. Where the matrix is made of non-conducting material, the parting compound serves the added function of conducting electricity and facilitating the electrodeposition process.

Permanent mandrels frequently are plated with tin or lead or some other fusible metal which melts away when the electroformed part is placed in a bath of hot oil. Other parting compounds for metal matrices include: lead powder-graphite mixture, solutions of selenium or arsenic salts, metal sulphides or chromic acid, collodion or mercury amalgams, potassium bichromate solutions, and others. One compound for permanent metal matrices contains: 4 pounds airspun graphite, 1 pound beeswax, ¼ pound rosin, and 1 gallon carbon tetrachloride.

For wax, plaster, plastic, and other non-conductive matrices, electrical conductors such as graphite or metal powders are applied over or with a thin coating of cellulose, lacquer, or shellac.

There are many different parting compounds available: the selection of the correct one for any given job depends on such variables as the nature of the matrix, the type of part being formed, individual pref-

erences of person in charge of electroforming operation, and, quite frequently, the result of extensive trial-and-error experimentation.

In all events the parting solution must be applied evenly and smoothly to the exterior of the matrix and as thinly as possible so that no large allowances need be made for the thickness of the parting solution when the matrix is fabricated.

Electroforming Operation

The actual forming operation usually requires a long time, since the rate of deposition is slow, varying from 0.001″ to 0.1″ per hour. Approximate ranges of rates of deposition for the following metals are:

Copper	0.005″ to 0.1″ per hour
Iron	0.001″ to 0.003″ per hour
Nickel	0.01″ to 0.1″ per hour
Silver alloy	0.003″ to 0.03″ per hour

The length of the electroforming operation does not add greatly to the cost of the finished product, since very little handling or supervision is required once the matrix is in the electrolytic bath. To insure even distribution of the electrodeposited metal, the object or plating media should be so handled that all sections of the part are exposed evenly to the metal carried in solution. Round or symmetrical parts are so mounted that they can be rotated during forming. For flat objects and other forms that do not lend themselves to such handling, the bath itself is agitated. To insure further that there is an even distribution of the deposited metal, attention should be given to location of conductors in or on the mold. Ideally, there should be as many points of contact as possible arranged equally over the surface.

Fig. 5—Electroformed silver lighter case.
Courtesy Camin Laboratories, N. Y.

Fig. 6—Electroformed paint mask made by plating onto leather with an embossed design. Electroformed of copper then nickel plated.
Courtesy Conforming Matrix Corp., Toledo, O.

Properties of Electroformed Metals

The electroformed part possesses engineering properties which are equal to or superior to the same metal in the cast, wrought, rolled or forged states. The physical properties to be obtained can be seen from the following tabulation:

Metal	*Brinell Hardness*	*Tensile Strength P. S. I.*	*Elongation %*
NICKEL			
Hard, stress-free, as formed	130-500	up to 132,000	up to 20
Very hard, as formed	400-575	up to 160,000	up to 9
Very hard, stress annealed	300-400	up to 90,000	up to 30
Fully annealed, recrystallized		45,000-55,000	up to 50
COPPER			
Stress-free, as formed	30-120	30,000-68,000	5 to 20
Cold worked, ductile	65	up to 102,300	40
IRON			
Stressed, as formed	225-350	50,000-110,000	5 to 20
Annealed	140-165	40,000-55,000	27-40
COBALT			
As formed	150-375		
SILVER			
As formed	50-300		

The electroformed part usually has low internal stresses, hence possesses superior dimensional accuracy as well as excellent machineability. As indicated in the above chart, the electroformed part can be annealed and heat treated to modify or improve its physical properties. For example, electrolytic iron may be case-carburized to a depth of 0.100″ and heat treated to produce hardnesses of from 16 to 62 Rockwell C. By changing the nature of the bath, tensile strength of nickel can be varied from 50,000 psi (low pH Watts bath operated at 140° F. and pH 2.0 to 2.5) to 150,000 psi (double salt hard bath with temperatures varied from 120° F. to 140° F., the pH from 5.2 to 5.9 and the current from 20 to 50 asf.)

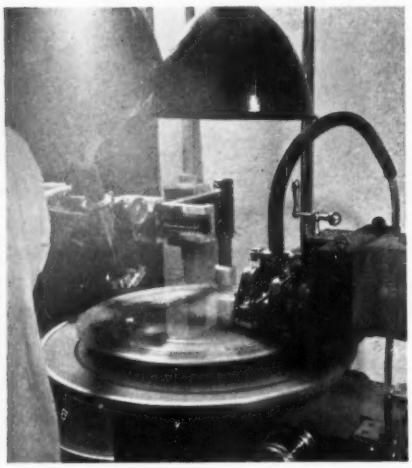
As industry gains added experience with this fabrication method, even more precise methods for controlling physical properties will be forthcoming. The regulation of hardness, tensile strength, elongation, and other properties of the electroformed part is approaching the nature of an exact science.

Reference

1. Safranek and Faust—*Plating*, Jan., 1948.

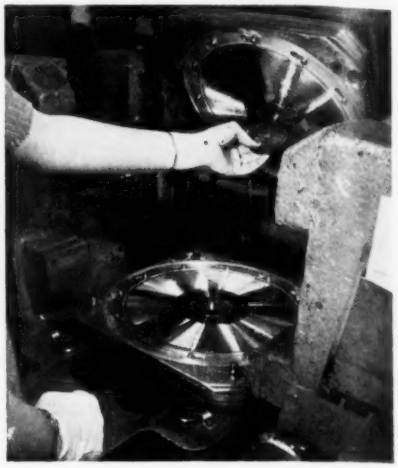
Electroforming Phonograph Record Molds

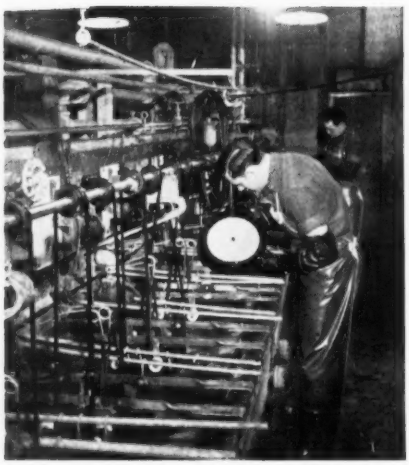
Among the earliest applications for electroforming was in the phonograph industry. The use of this process in the fabrication of a conventional phonograph record is shown in the photographs. (*All photos courtesy of RCA Victor.*)



Left—Cutting the wax master in the recording studio. This wax master is then sent to the electroforming department.

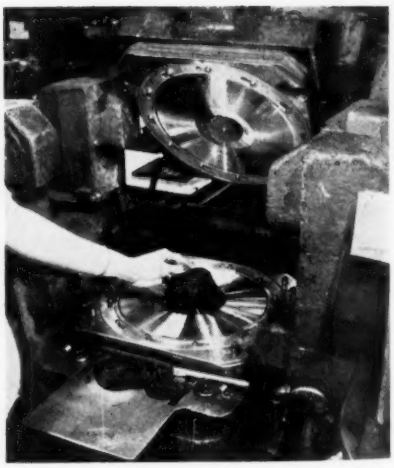
Right—Stampers mounted in the plastic press ready for molding a record. Note the record identification discs, which are molded in the center of the record, and the plastic "biscuits," or preforms.





Left—After the wax master has been rendered conductive by one of several possible methods, it is placed in the electroforming tanks in a continuously rotating fixture, where the required amount of metal is plated upon it.

Right—Operator is shown placing the plastic "biscuit" in the press, which will squeeze it out under heat and pressure to form the finished record. A thin flash chrome plate is often used on the stamper faces to prolong their life.



Left—Separating the electroformed metal master from the wax impression. This master is a reverse of the wax, and is now used to electroform a metal duplicate of the original wax, which in turn is used to electroform the stamper used in the actual molding operation.

Right—Operator inspecting the finished molded record. After the flash is trimmed from the outer edge the record is ready for shipment.

Development of Alkaline Cleaners

By Robert H. Tiers, *Research and Development Dept., Pennsylvania Salt Mfg. Co.*

Mr. Tiers is a graduate of the University of Connecticut. He has been a member of Pennsalt's chemical staff at the Whitemarsh Research Laboratories since 1945. *Prior to that he was a chemist and production foreman for Pratt and Whitney Aircraft. He is a member of the American Electroplaters' Society.*

PRACTICALLY nothing is known concerning the earliest methods of metal cleaning. If we go back to the ancient Egyptians, archeologists tell us that four thousand years ago Egyptian metalsmiths were successfully coating base metals with gold and silver. Tomb drawings and accompanying hieroglyphs, along with plated objects, tell the story fairly clearly. Some of the plated objects have been examined and the plated coating found to have good adherence to the base metal. All ancient plating, by the way, was probably done by molten metal baths or foil. Based on our knowledge of getting good adhesion of metal coatings, it is logical to assume that the old boys cleaned the base metal in some manner. Unfortunately a cleaning process would be very difficult to depict in stone carvings and drawings. The cleaning would be considered of secondary importance to the actual coating process, even as it frequently is today; but no such stone recording is recognized, although there are series of pictures dealing with goldsmiths and possibly one of the pictures was intended to represent the cleaning operation.

Cleaning of metal must also have been done by the ancient Incas or Peruvian Indians, as much of the supposedly solid silver and gold loot of Pizarro was later found to be only plated. The same holds true for ancient Greeks and Romans, Englishmen and Spaniards, where counterfeit coins were made by plating copper and platinum slugs with gold and silver. In all probability removal of soil from metals in ancient times was done with a mild abrasive, either wet or dry. There is also historical reference to the use of fruit juices on metals to be plated. This, of course, provided citric acid which removed oxides and probably accounts for the good adhesion previously mentioned.

Cleaning of metals, then, is by no means a new problem. The first piece of metal cleaned was probably scrubbed by hand, and that method is still used when all other methods fail. For instance, during the second World War, and right up to the present day, at least one large aircraft engine manufacturer hand scrubbed every silver lined bearing with powdered pumice and a mild alkaline solution prior to lead plating.

Metal cleaning methods have been greatly improved since the time of Watt and Langbein. The greatest progress has taken place in the last two decades with the introduction of new chemicals and methods, and improvement of the old. At the turn of the century no plating room was complete without a scouring table containing compartments for acid jugs, rinse water, potash solution, a pumice container and scrubbing board and brush rack. Prior to scrubbing, parts to be cleaned were soaked in the warm potash solution of about 8.0 oz./gal. An item of interest here is the control method which is quoted from Mr. Watts: "The workman may readily determine when the solution has lost its active property by simply dipping the tip of his finger in the solution and applying it to the tip of his tongue. When it fails to tingle or 'bite' the tongue, the solution has lost its caustic property and may be either thrown away or strengthened by the addition of more caustic."

The period from 1900 to the beginning of World War I saw increased interest in solvent and electrolytic alkaline cleaning and some mechanized equipment began to appear. The applications of electrocleaning were necessarily limited by the capacity of batteries or dynamo-electric machines then in use. Some proprietary electrolytic alkaline cleaners usually containing caustic with soda ash and/or sodium cyanide had begun to appear. To quote Langbein, the cleaning was accomplished by "copious evolution of oxyhydrogen gas." Barrel cleaning was being accepted on a small scale, using such mixtures as sand, leather and a small amount of alkali. World War I saw few major advances in the art of cleaning metal, but the popularity of electrolytic cleaning was growing. Spray or paddle-type washing machines were appearing in the most progressive plants.

By 1930 hand scouring was no longer taken as a matter of course. Other methods were investigated first and used whenever practical. Sodium compounds had replaced the more expensive potassium salts, and phosphates and carbonates were playing an active part in alkaline cleaners. Aluminates, borates, and metasilicates were also coming into use. By this time the addition of soaps was not uncommon for soak type cleaners. Electrolytic cleaning had come into its pres-

ent importance with direct and reverse current cleaning in the same bath being generally accepted.

The decade of the thirties appears to have been the period of greatest advancement in alkaline cleaning methods and materials. These developments were brought about by the pressure of more exacting cleaning requirements of the then new bright nickel solutions. Cleaning procedures that had formerly been considered satisfactory were found to cause a cloudy plate with the bright nickels. The highly alkaline silicates were introduced during the thirties. Alkaline silicates of the orthosilicate ratio were introduced in 1935. The superior detergent power and neutralizing capacity of these quickly established them as cleaning chemicals of major importance. This period also saw the wide acceptance of synthetic surface-active agents and a tremendous rise in the acceptance of carefully formulated proprietary cleaners. This trend continued through the forties and is widespread today. The cleaning developments of the forties have been more in the line of equipment and methods than chemicals, but more expert compounding of proprietary cleaners for specific soils and purposes has widened their acceptance. Short cycle electrolytic cleaning, almost entirely with reverse current, prior to electroplating is the order of the day. Plain soak cleaners, containing large percentages of soaps, continue in widespread use wherever the relatively inferior cleaning results can be tolerated. The trend to anodic cleaners has seen the development of many specialized nonferrous cleaners; such as, cleaners for zinc die-castings and brass that permit up to two minutes anodic cleaning without deleterious effect on the plated coatings or adhesion to the base metal.

The old scouring table that used to be in every plating shop has now pretty well disappeared. In its place we find a huge machine containing an awesome array of equipment such as tanks, sprays, conductors, steam coils, lifts and conveyors. Into one end of this machine one man usually will feed soiled parts while at the other end another man will remove perfectly cleaned parts ready for plating, or even completely plated.

There have been many patents issued on alkaline metal cleaners but no attempt will be made to cover them at this time as that subject would make an extensive talk in itself.

There is very little mystery about alkaline cleaners except why and how they work. The alkaline materials, surface active ingredients and emulsifiers and water hardness agents all must be carefully adjusted to get a correctly balanced cleaner. The main reason that proprietary alkaline cleaners are generally favored is that large volume compounders are in a position to make the cleaners much more economically than the individual consumer; and, of course, can usually much better afford the funds and laboratory facilities necessary to develop and test a balanced formula.

The main ingredient of alkaline cleaners is nearly always a silicate, phosphate or carbonate; their efficiency as detergents is in that order. To give higher alkalinity, and consequently greatly increased efficiency and length of useful life, caustic soda is usually added in varying amounts. This may be done by mixing the ingredients mechanically or, preferably, by reacting molten ingredients to form a fused product which is uniform throughout and essentially anhydrous. With rising freight rates this last factor is becoming of increasing importance.

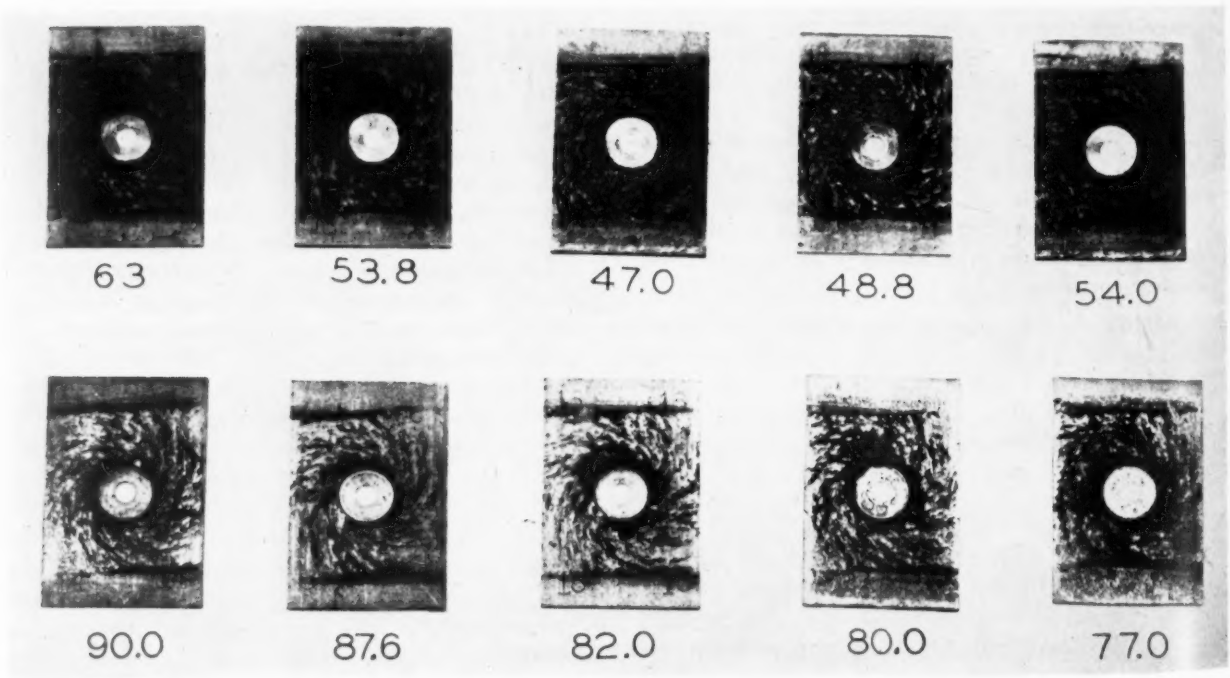


Figure 1. Two sets of (5) panels comparing the efficiency of alkaline cleaners "A" and "X", tested at 180°F. Time of rotation in bath was 3 minutes. The figure under each panel is the percentage of soil removed. Cleaner A removed an average of 53.3 per cent of the soil whereas Cleaner X removed an average of 83.3 per cent in 3 minutes. By varying the period of rotation it is possible to appreciably change the percentage of soil removed, as shown in Figure 2.

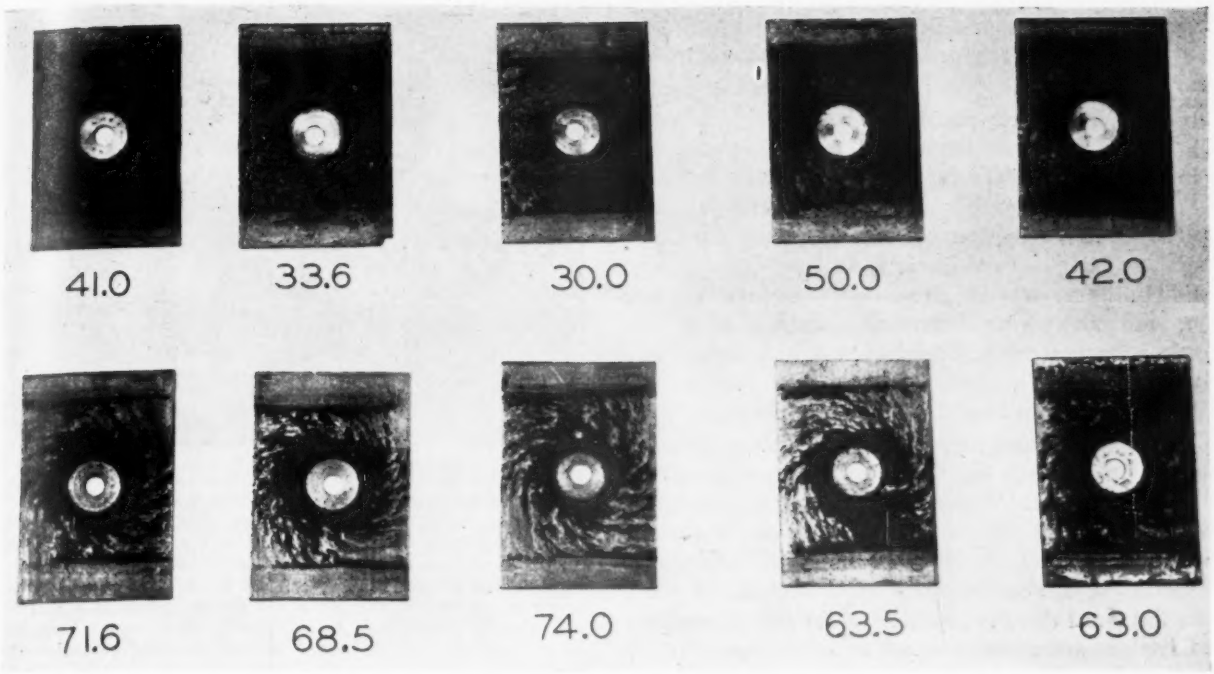


Figure 2. Two sets of (5) panels comparing the efficiency of alkaline cleaners "A" and "X', tested at 180°F. Time of rotation in bath was 1 minute. The figure under each panel is the percentage of soil removed. Cleaner A removed an average of 39.3 per cent of the soil whereas Cleaner X removed an average of 68.1 per cent.

The vitally important reason for using higher alkalinity with silicated cleaners is that high alkalinity will prevent the formation of the troublesome silicate film which forms on work when silicates having a 50% or higher SiO_2 content are used. This, of course, means a 1:1 or 1:2 ratio and on up in silicate content. This silicate film deposited at lower alkalinities may not be aparent at the time of cleaning but will show up after plating by causing a dullness of the plate and other faults such as poor adhesion. If the pH or alkalinity is kept on the higher side, using a ratio of Na_2O to SiO_2 of at least two to one, then the film will not form. This statement is, of course, contrary to a great deal of published data but is, nevertheless, true. It has been well proven by continued widespread industrial use of the higher alkalinity silicated cleaners with very satisfactory service of plated coatings. There is a simple test which will also demonstrate this point. Simply immerse a piece of aluminum in a 10% solution of soda ash and gassing will start immediately showing attack on the aluminum surface. Then add a small amount of a 1 to 2 ratio silicate and the gassing will soon stop; yet there has been no appreciable change in pH of the solution, indicating that a protective film has been formed on the surface of the aluminum. Now add a little caustic soda or a silicate of higher alkalinity such as a 2 to 1 ratio and gassing will resume, showing that the film has been destroyed.

To formulate an alkaline cleaner the first thing that must be considered is the types of soil which are to be removed. For instance, if the soil contains a large percentage of saponifiable material it can probably be best removed by having a highly alkaline solution which will react with the saponifiable portions to form its own soap and readily disperse itself. If, on the other hand, the soil has very little or no saponifiable material, such as a straight petroleum oil, then emulsification power and lowered interfacial tensions are usually needed in the cleaner, as the cleaning action becomes one of at least temporary emulsification or possibly flotation. I mention temporary emulsification because there are highly efficient cleaners on the market which remove soil apparently through emulsification and yet the emulsion must break, as a layer of oil will eventually float on the surface of the bath. There are cases where this type of cleaner proves very efficient, as the oil layer can be removed by floating it off through the tank overflow, and the cleaning solution continues to function efficiently. If all this oil had remained in the bath and been permanently emulsified it would be only a question of time until the saturation point was reached and the bath would not clean the work. Then there are such soils as line-based cup greases, heavy metal soaps, sulfurized oils, asphalts and heavy greases and innumerable others, each of which poses a different problem of removal. The ideal alkaline cleaner, of course, would be one which would remove unlimited quantities of any soil indefinitely. This Utopian cleaner has never been formulated and in all probability never will be. As a matter of fact, it is a rare case when the formulator knows *exactly* what soil his new cleaner will be required to remove. He usually works on generalities of the various types of soil which may be encountered in a given industry.

After considering the type of soil to be removed we then turn to compounding the alkaline cleaner. What are the properties which an alkaline cleaner must have in some degree, at least, if it is to function efficiently? I have listed the properties and attempted to place them in their order of importance for a general purpose cleaner. This order may, of course, change for a

cleaner which is compounded for dealing with a specific type of soil. The order in which I have rated them is:

(1) Dissolving power and high alkalinity
(2) Dispersing power for solids
(3) Emulsifying power for liquids
(4) Free rinsing
(5) Low surface tension or wetting ability for soil and metal
(6) Stability
(7) Conductivity (for electrolytic cleaners)
(8) Low concentration for use
(9) Economy
(10) Freedom from hazards—toxicity or flammability.

Probably the most important single factor in any cleaning operation is the ability of the cleaning solution to wet the soil. This statement will appear contradictory in view of my having previously rated a low surface tension as No. 5 out of ten important properties of a cleaner. It is contradictory in one sense but I feel there is justification for this statement as there are many instances where a combination of the other factors far outweighs the importance of wetting in the usual sense of the word. For instance, there are many surface-active agents available which when dissolved in plain water will give the water excellent wetting ability for metals, yet will have practically no detergency value against soils customarily encountered in metal cleaning.

Alkalinity is of prime importance, because when the solution comes in contact with dirt which contains free acid this acid must be neutralized and, of course, more alkalinity must be present for further cleaning needs. This is where the available alkalinity comes into importance and why we hear so much of available alkalinity above pH of 10.

The types of soil commonly encountered in industry will consist usually of a dirt or solid material held on to the work by binding agents such as oils and greases. Removing the adhesive or binder or vehicle, whatever you want to call it, is the first step which takes place in cleaning. This can be accomplished by emulsification, solution, chemical reaction or what I have called flotation, where a soil such as a light oil simply gathers in globules and floats off (a phenomenon which takes place when the interfacial tension between cleaner and metal is less than that between the soil and the metal). It is the insoluble dirt that generally makes the real problem.

Dirt can normally be removed two ways, namely (1) by causing the solution to flow between the dirt and the metal and (2) by chemically disintegrating the soil by either solvation or by chemical reaction. A valuable adjunct, of course, to other methods of removing dirt is mechanical action such as agitation or power spray washing. Where dirt is physically removed from metal it is of vital importance that once dislodged, it must be suspended or dispersed, so that it will not redeposit on the work. For this phase of cleaning the degree of alkalinity is not of such importance.

Having determined what alkalinity is permissible, it is then generally desirable to use the highest value

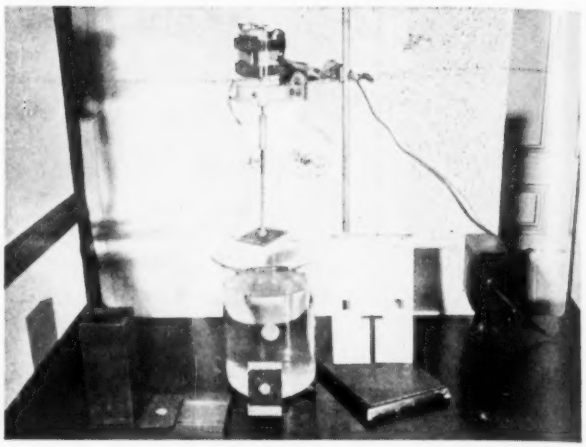


Figure 3. At the top of the photograph is an electric motor with shaft extending downward. Test plate is bolted to motor shaft which turns at 200 RPM. Baffle shown to the right of beaker is inserted vertically in the beaker and test plate rotates through horizontal slot in baffle which virtually eliminates induced circular motion of the solution. In front of the beaker is a typical soiled test panel. At the left is the sliding applicator for applying prepared viscous soils to test panels. The cleaning solutions to be evaluated can be tested at any practical concentration, temperature and period of time. The soil used consisted of: medium cup grease 27.0 g.; SAE 20 Oil 16.0 g.; powdered asbestos 30.0 g.; powdered charcoal 15.0 g.; Indusoil 0.5 g., Ceresin wax 10.0 g., and sufficient carbon tetrachloride to give proper consistency for application (about 33.0 ml.). The panels are held twenty-four hours or warmed in an oven to drive off the carbon tetrachloride before use. This soil formula may be changed to more nearly approach actual production soils.

possible. Then, depending on its intended use, other ingredients are included in the formula to obtain the most efficient balance. You can not have everything at full strength. Great care must be taken in selecting surface-active agents and emulsifiers, particularly in combinations of the two. Some types of synthetic detergents and soaps will be deposited on the work during electrolytic cleaning in highly alkaline solutions. There are also many combinations of surface-active agents and emulsifiers in which the surface active agent will break the emulsions formed by the emulsifier when the emulsion reaches a certain concentration. It is obvious that when this occurs the bath "breaks down" and loses much of its ability to clean efficiently. Formation of certain types of soaps in the bath must be avoided by excluding from the formula any of the ingredients necessary for their formation. This is very important, as some soaps are extremely hard to rinse. If a trace of this soap is on the work when it reaches the acid dip the soaps will break down and leave a fatty acid film on the work that can completely ruin adhesion of subsequent plated coatings. Synthetic detergents are surprisingly specific regarding the types of soil for which they can be efficiently employed. Careful selection of the correct surface-active ingredients cannot be over emphasized.

During the compounding of an alkaline cleaner, and after the formula is completed, we are constantly faced with the thorny problem of testing. If you can visualize the overall picture of alkaline cleaners from formula development to consumer use, testing or evaluation is the one point where everyone has fallen down; compounders, manufacturers, sales forces and consumers alike. Working entirely on theory and past experience, a compounder can put together a

formula which should be excellent. Yet, as a former consumer, I can say that I have seen some of these "miracle whips" reach the practical trial stage and fail miserably in production. This is because the compounder's testing methods were inadequate, assuming, of course, that the compounder was on his toes and did actually first test the product in the laboratory.

Lets look for a minute at testing methods. First we have the acid titration methods for total and available Na_2O with methyl orange and phenophthalein. Then we have the old water break test where we clean a metal panel and rinse for a definite period of time and then examine for water breaks, usually for a period up to one minute. This is indicative, but not entirely reliable, as some surface active agents are not free rinsing and a mere trace of one on a panel surface is sufficient to cause a water film to bridge over soil and prevent a water break, even if the panel is allowed to dry. Also, many solid soils and films will not cause a water break. We have the combination test of waterbreak followed by bright nickel plating. A solid soil or film will cause a dullness of the plated surface. This test has its use, but again is not entirely reliable since the panel is immersed in acid prior to nickle plating, and soil may be dissolved in the acid, causing the panel to plate satisfactorily. Yet in production the acid becomes contaminated and eventually causes trouble because it was doing a job that the cleaner should have been doing. There is a test method used wherein a steel panel is cleaned, rinsed and then immersed in a weak copper sulphate solution. If the panel becomes uniformly coated with copper it is supposed to be clean. This test may be indicative but again is not reliable. Electrocleaning a stainless steel panel under conditions to be used in production cleaning of other metals is a method for testing for the presence of metallic impurities; a smut showing that metallics are present. This test has its place, although substances other than metallics will also cause smut. Also, when testing for the presence of lead it is necessary to clean separate panels anodically and cathodically, as lead may plate out as either a metal on the cathode or yellow lead oxide on the anode. Sulphur also will deposit differently under different conditions. There are numerous other testing methods such as the use of ultraviolet light; the rotating electrode; and also a direct visual comparison of artificially soiled panels cleaned in separate solutions. Experience in this process has taught that the eye should not be trusted too far. There is the test developed by *Spring* which pretty much eliminates the eye as a comparator and has the added advantage of a permanent record. (*See Metal Finishing—March* 1950.) This test certainly has its place. There is the method of testing which employs the degree of adhesion of a plated coating as a criterion of the efficiency of the cleaner. This method is good, but too much depends on other factors in the cycle, such as the acid used, etc., to be entirely conclusive regarding the cleaner. Yet with all these tests we still find that we need better, quicker and more reliable methods for testing and evaluating alkaline cleaners.

A few years ago we evaluated many of the known testing methods in our laboratory and decided that a gravimetric method was sorely needed, as such a method would entirely remove the personal factor. Going on this theory we partially developed what I chose to call the "Swirl Method." (See Figures 1, 2 and 3.) This consists of carefully weighing a panel, applying a synthetic soil to the panel and reweighing it and then slowing rotating it, immersed in the cleaning solution, under carefully controlled conditions of concentration, temperature and time. The panel is then rinsed, dried and reweighed and the soil weight loss computed in percentage. There were a great many "bugs" in the method, but after some of these were worked out we were able to get consistent results by taking the average of five panels. The tests were repeated a few months later with a different operator and again gave the same results indicating that the method gives reproduceable results. One obvious disadvantage of this method is that an analytical balance is necessary and this, of course, eliminates the method for "on the job" production use. Also, it is time consuming. The method has not been perfected but is definitely worthy of further development.

Lately we have been hearing of the use of soil containing radioactive isotopes as a method for determining cleanness of metals. The method has not been extensively studied as yet but probably will have certain applications. New methods of testing cleaners are badly needed, particularly a test which will reliably predict what the life of a given cleaner will be in production; and also methods which will quickly evaluate a cleaner using the customers' production parts and soil and conditions, preferably right on the job.

Electroplated Tin-Zinc Alloy Coatings on Iron and Steel*

By E. E. Halls

Comparative corrosion resistance of tin-zinc, cadmium, and zinc electroplated coatings are given, together with notes on the solderability of each type of coating.—ED.

CADMIUM and zinc are the normally recognized electroplate coatings for the protection of iron and steel. They provide sacrificial protection in the sense that they are electropositive to iron and, under adverse circumstances, they provide protection by themselves corroding. Naturally, they each have their shortcomings as well as advantages, and each has passed through periods of condemnation, generally resulting from faulty application rather than inherent defects.

Comparative Merits

With cadmium, premature failures have been experienced due to flaking, rapid whitening and early rusting. These have been traced to mere flash coatings or deposits of inadequate thickness; to strained coatings due to excessively high-current densities; and to faulty process control causing erratic, non-uniform coatings. With a proper appreciation of these features, cadmium plating has emerged to be recognized as a sound protective finish for iron and steel, and in some industries it has been standardized as the preferred electroplate coating for this purpose. It has better resistance to humid conditions, particularly to high humidities and condensation, than has zinc plating, and it exhibits good resistance to marine conditions. It is favored by the radio industry, not only for these reasons, but also for its good appearance, retention of this appearance, and on account of the ease with which soldered contacts can be made to it using non-corrosive resin fluxes. Its resistance to deterioration can be further enhanced by the simple process of chromate passivation.

With zinc plating, early serious failures were all due to inadequate thickness of coating. Poor results may also result from the use of the easily maintained sulphate electrolyte which has a deplorably poor "throwing power," and which, therefore, provides very little protection on the insides of bends and in recesses. The cyanide electrolyte overcomes this defect, although its throwing power is not quite so good as that of the cadmium electrolyte. This solution is more difficult to maintain, but no trouble arises if laboratory control is exercised. Uniformity of appearance is not so good as with cadmium, nor is resistance to humidity. Rapid whitening occurs under conditions of condensation and soldering is not practicable using resin flux. Generally speaking, zinc-plate coatings need additional protection to offset this deterioration under damp conditions—i.e., in most cases it is essential for zinc but not so for cadmium. Chromate passivation gives this preservation in a very simple and economic manner, but the resulting appearance is not always acceptable on account of variegated color. Lacquering with a thin film of nitrocellulose lacquer is a usual procedure for safeguarding this shortcoming. The soldering problem can be solved by the provision of "tinned tags"—i.e., tags formed by punching the component or by spot-welding separate tags which are hot tinned or soldered prior to plating or by mere mechanical contacting.

Two other facts concerning cadmium must not be overlooked. The first is cost, which, during the last few years, has been very high indeed. The other is availability; total cadmium production is small and probably could not supply all the needs that are satisfied by zinc. Furthermore, in recent years periods have been encountered, and are likely to be re-encountered, when cadmium has not been available for finishing purposes.

The tin/zinc alloy platings are relatively new to industry, and in consequence results from years of experience with them, as with zinc and cadmium platings, cannot be cited. Premature failures, however, are not anticipated because the need for process control, and for adequate and uniform thicknesses, are appreciated by all who adopt the process. The coatings exhibit very good resistance to salt conditions; and quite a good performance under damp exposure, the latter quality being further improved by a simple chromic acid passivation treatment. The coatings are solderable. Over the surfaces of irregular shaped articles, some variation in the ratio of tin to zinc in the coating must be expected, however closely the process is maintained.

Plating Process

With the tin/zinc alloy platings, alloys of a range of composition can be deposited, the two generally exploited being 50/50 and 80/20 tin-zinc. Anodes of the respective composition are employed, and electrolytes of the appropriate composition have to be used; full details are provided by the Tin Research Institute and the following processing data are taken from their publications. The recommended conditions are as follows:—

	80/20 alloy	50/50 alloy
Tin content of electrolyte ..	30 gm./litre	30 gm./litre
Zinc " " "	2·5 " "	8 " "
Free sodium hydroxide	4–6 " "	6–8 " "
Sodium cyanide	25 " "	50 " "
Cathode current density	15/30 amp./sq. ft.	15/30 amp./sq. ft.
Temperature	70° C.	70° C.

* *Reprinted by permission from Metallurgia, Dec.* 1949.

TABLE I.—AVERAGE OR LOCAL THICKNESSES OF TIN-ZINC ALLOY COATING ON TEST SPECIMENS

Sample No.	Nominal Average Composition of Coating %	Nature of Test Pieces	Position of Thickness Test	Total Thickness of Coating Inches × 1,000	Actual Composition of Coating	
					Tin %	Zinc %
1	80 Tin, 20 Zinc	Flat panel.	½ in. from corner.	1·10	74·0	26·0
			Centre of panel.	0·73	75·6	24·4
2	ditto.	Large formed and perforated component.	Centre of side flange.	0·87	73·5	26·5
			Centre of main surface.	0·68	76·1	23·9
3	ditto.	Small angular pressing.	Average.	1·30	72·8	27·2
4	50 Tin, 50 Zinc	Large formed and perforated component.	Centre of side flange.	0·61	66·2	33·8
			Centre of main surface.	0·47	71·9	28·1
5	ditto.	Small angular pressing.	Average.	1·12	49·5	50·5

TABLE II.—PERFORMANCE OF TIN-ZINC ALLOY-PLATED MILD-STEEL COMPONENTS UNDER SALT-SPRAY TEST

Sample No.	Type of Tin-Zinc Alloy	Period of Salt-spray Test in Days		
		1	7	21
1..	80/20	Surfaces generally darkened together with slight white corrosion patches, heavier near edges.	White corrosion heavier, otherwise no change.	White corrosion still heavier, otherwise no change. No rusting.
2..	80/20	General darkening of appearance and very slight white patches giving an overall mottled appearance. Areas at inside angular corners unaffected.	ditto.	ditto. Inside corners still not affected.
3..	80/20	Dark background with slight white corrosion patches, giving mottled affect, but with inside corners unchanged.	ditto.	ditto.
4..	50/50	White corrosion rather heavier than in sample No. 2, otherwise similar deterioration.	ditto.	ditto.
5..	50/50	White corrosion heavier than in sample No. 3, but deterioration similar in other respects.	ditto.	ditto.

TABLE III.—PERFORMANCE OF TIN-ZINC ALLOY PLATED MILD STEEL COMPONENTS UNDER TROPICAL TESTING TO W.T. BOARD SPEC. K.110.

Sample No.	Type of Tin-Zinc Alloy	Performance under the following cycles				
		1 dry	4 wet	8 wet	12 wet	21 wet
1	80/20	Unaffected.	Darkened to dirty appearance.	Very slight whitening on dark background.	Further whitening and a few tiny rust spots developed on centre of plate.	White corrosion not very intense although appearance dirty and unattractive. Rust spots numerous but not large.
2	ditto.	ditto.	ditto.	Slight whitening on dark background, a few rust spots developed.	Further whitening and a few more tiny rust spots formed.	White corrosion not heavy, many general rust spots, but also patches of them on unwhitened areas adjacent to inside corners.
3	ditto.	ditto.	ditto.	Slight whitening on dark background.	Further whitening, but no rusting.	Slight further whitening, dirty appearance, but only a few rust spots.
4	50/50	ditto.	Darkened generally with some white corrosion areas. Rust spots on areas at inside bends, which were otherwise unaffected.	Rust spots developing generally on inside surfaces.	Inside surfaces heavily spotted with rust.	White corrosion on outside surfaces on a darkened background, but no rust, heavy rust on inside surfaces, especially adjacent to angular bends.
5	ditto.	ditto.	Darkened to a dirty appearance.	General white corrosion beginning to develop.	Further whitening.	General fairly heavy whitening but no rusting.

It will be noted that the electrolyte is, in effect, a combination of the sodium-stannate tin and zinc cyanide solutions. It is strongly alkaline, and therefore the containing tank can conveniently be iron. As in stannate tin plating, the tin in the electrolyte must be maintained in the stannate condition and the anodes in the filmed condition. The filming follows the same practice as in tin deposition—i.e., it is achieved by slowly lowering them into the solution with the current on, or by inserting all the anodes and polarizing for a few seconds at high voltage. Once filmed, the anodes can safely be left in the solution without current flowing for an hour or two, but if the installation is out of use for longer periods, they should be removed.

Proper control ensures uniform operation of the process. The Tin Research Institute state that the composition of the plate deposited is a linear function of the caustic soda content of the electrolyte, and analysis for this ingredient provides the main simple control. Cyanide becomes hydrolyzed and reduces relatively rapidly, as would be expected in a solution operating at a high temperature, and this may necessitate daily additions in large vats. Tin and zinc should not vary greatly and only require infrequent periodic checking. Carbonate gradually increases due to decomposition of the cyanide and absorption of carbon dioxide from the atmosphere, and this operates in the direction of reduced cathode efficiency. This is not very serious, however, and in excessively carbonated solutions, the loss does not exceed 20%. Periodically, carbonate may require removing, cooling and crystallizing being the method employed. Traces of nickel markedly reduce the cathode efficiency, so that contamination by this element must be carefully avoided.

After plating, work is thoroughly washed in cold and hot waters, and may then be dried or passivated. The latter comprises a few seconds immersion in a 2% solution of chromic acid. Fifteen seconds at 50°C. or 5 seconds at 80°C. give a guide to the temperature/time relationship for this immersion. Cold and hot water rinsing, and drying follows. The passivation

treatment does not affect the grey-white color of the finish unless the immersion times are extended, in which case, a yellow or brownish coloration results which is not detrimental except from the color point of view. The passivation helps to minimize finger-mark staining, and does add to the protective value of the coating insofar as it adds to its humidity resisting properties.

Tin/zinc plating can follow the usual sound cleaning and preparatory treatments. Iron and steel are the usual metals to which the process is applied, but there is no reason why it should not be applied to the non-ferrous metals. When used on soldered components, the normal practice of a preliminary deposition of copper from a cyanide or Rochelle salt solution may be adopted; alternatively very thorough cleaning of the solder areas is necessary, using a wire brush and pumice, otherwise blistering at these points is liable to occur.

Tin itelf is not normally employed as a protective electroplate coating on iron and steel because it is electro-negative to iron. When it is used on steel components for specific reasons, a minimum average thickness of coating of 0.001 in. is desirable. Under comparable circumstances, minimum average thicknesses of 0.0005 in., or minimum local thicknesses of 0.0003 in., for both zinc and cadmium are stipulated. For normal service conditions, 0.0005 in. minimum average thickness of tin/zinc, or 0.0003 in. if passivated, is usually recommended, with greater thicknesses for more severe conditions. The tin/zinc alloy would be expected to resist damp conditions without white corrosion better than zinc itself, and without pin-hole rusting better than tin. Its soldering properties should be akin to those of tin itself itself, with better solderability the higher the tin content. This anticipated performance is achieved in practice.

It will be appreciated that in plating components, the uniformity, or lack of uniformity, of the deposit over the surface of each article, is primarily dependent upon the "throwing power" of the electrolyte, and secondarily upon control of conditions to achieve the best possible throw. In alloy plating, equal throw of the constituent metals cannot be anticipated. With tin/zinc, the tin exhibits better throwing power than the zinc, so that on prominences the zinc content of the deposited alloy may be rather higher than the average, while in remote areas and in recesses it will be lower. At the bottom of very deep recesses, almost pure tin may be deposited. Disposition of anodes can be adjusted to some degree to minimize the discrepancy. At the same time it is important to note that the throw of tin/zinc is markedly superior to that of zinc alone, even when the latter is plated from cyanide electrolytes. In fact, inside sharp corners and bends of components that do not become covered in zinc plating, become plated from tin/zinc alloy electrolytes.

Durability Tests

In the following, typical durability test results are presented for irregular steel components plated with tin/zinc finish, with comparative average data for zinc and for cadmium coatings. Table I gives thickness values for the tin/zinc alloy plating on samples of the specimens subjected to tests. The position at which the thickness was determined is indicated, the actual estimation being made by cutting a specimen approximately 1 in. square, stripping the finish from it in cold concentrated hydrochloric acid, and analyzing the solution obtained for tin and zinc. The values indicate very good throwing power of the tin/zinc alloy as a whole, and the rather greater throw of the tin. The latter is shown by the values for percentage tin in the coating being a little higher in the center of main surfaces than near corners or on side flanges.

Table II deals with these components under a vigorous salt-spray test. The conditions comprised exposure at room temperature to the mist produced by atomizing 20% salt solution with clean, moist compressed air. The specimens were obliquely arranged in the test cabinet and protected by glass baffles from the impingement of large droplets. The atomizer was operated during the eight-hour day period, and the specimens left in the mist-laden chamber overnight. Before re-starting the atomizer, the samples were removed, rinsed in cold running mains water and dried on a soft cloth for examination. The details of performance during the test, show the value of the coating in giving protection against salt atmospheres, the lack of rusting at the end of 21 days being regarded as very good indeed. It will be noted that the heaviest white corrosion products formed at areas where the zinc concentration in the deposit would be highest, and that no such deterioration occurred in inner corners where the tin predominated.

Table III details performance under cyclic tropical testing to Wireless Telegraphy Board Specification K.110. The cycles were of 24 hours' duration, the dry one being 6 hours dry heat at 71°C., and the wet one 6 hours at 60°C. followed by cooling off with condensation upon the specimens in the moisture-laden cabinet for the remainder of the 24-hour period. It will be seen that under these conditions, the coating fulfills its role of protecting by itself deteriorating, no very serious degradation of the base metal occurring. The dry heat, as would be expected, is without effect, and the first four wet cycles cause slow attack on the coating. This results in the pleasing whitish grey appearance darkening and, by contrast, looking dirtyish; rust appeared on the inner bends of one sample only —i.e., the sample having the thinnest coating. At the end of the 21 wet cycles, it should be noted that of the two similar specimens, Nos. 3 and 5, No. 3 with higher tin content showed rust spots and No. 5 with lower tin was free from rust. In comparison, the 80% tin samples Nos. 1 and 2 had thinner coatings, and showed more rusting, whilst the 50% tin sample No. 4 had a much thinner coating and showed appreciable rusting. The rusting in all cases was associated mainly with the lower zinc areas of the coating—i.e., areas adjacent to inside bends and corners.

For comparison, typical durability test results are given for components zinc plated from cyanide electrolytes, salt-spray performance in Table IV, and K.110 tropical testing in Table V. Under the salt-spray, performance is very good, but the extent of

TABLE IV.—PERFORMANCE OF ZINC-PLATED MILD-STEEL COMPONENTS UNDER SALT-SPRAY TEST

Sample No.	Nature of Test Pieces	Thickness of Zinc Coating, Ins. × 1000		Period of Salt-spray Test in days		
		Minimum Local	Average	1	11	28
1	Flat panels.	0·3	0·5	Mottled appearance, dirty grey in colour.	General whitening, heavy white corrosion at edges.	Heavy whitening general, and a number of tiny rust spots generally distributed.
2	Miscellaneous angular pressed components.	0·3	0·62	Mottled appearance and white corrosion.	Outer surfaces showing signs of rusting, inner surfaces fairly heavily rusted (first signs in 7 days).	General rusting.
3	ditto.	0·6	1·2	Mottled appearance and white corrosion.	Heavy white corrosion, traces of rust on inner surfaces.	Fairly general rusting on inner surfaces, none on outside surfaces.
4	Large formed components.	0·6	1·0	ditto.	Heavy white corrosion.	Heavy white corrosion, but only minute traces of rusting on inside bends.

TABLE V.—PERFORMANCE OF ZINC-PLATED MILD-STEEL COMPONENTS UNDER TROPICAL TESTING TO W.T. BOARD SPEC. K.110

Sample No.	Nature of Component	Thickness of Zinc Coating Ins. × 1000		Performance under the following cycles :—				
		Minimum Local	Average	1 dry	4 wet	8 wet	12 wet	21 wet
1	Machined and pressed small components.	0·2	0·35	Unaffected.	Heavy white corrosion.	White corrosion heavier.	White corrosion heavier.	Very heavy white corrosion, few only rust spots.
2	Flat panels.	0·3	0·5	ditto.	ditto.	ditto.	ditto.	Heavy white corrosion, and a few tiny rust spots in centre of panels.
3	Large formed component.	0·3	0·5	ditto.	ditto.	A little rust inside bends.	Whitening more marked.	Very heavy white corrosion and appreciable rust inside bends, and on inside surfaces.

TABLE VI.—PERFORMANCE OF CADMIUM-PLATED MILD-STEEL COMPONENTS UNDER SALT-SPRAY TEST

Sample No.	Nature of Test Pieces	Thickness of Cadmium Coating Ins. × 1000		Period of Salt-spray Test in Days		
		Minimum Local	Average	1	14	28
1	Flat panels.	0·4	0·62	Slight general white corrosion.	Fairly heavy general white corrosion against a dark-coloured background.	White corrosion very heavy, a few tiny rust spots.
2	Miscellaneous small angular machined components and pressings.	0·15	0·25	Darkening in colour and slight white corrosion.	Rust started in 7 days, fairly heavy in bends and on inside surfaces.	General rusting rather heavy.
3	ditto.	0·3	0·5	Slight general whitening.	White corrosion against a black background.	Some rusting, but not very general.
4	ditto.	0·6	1·0	ditto.	ditto.	Little further deterioration : no rusting.

corrosion of the coating is heavier, and the appearance of rusting earlier than with the tin/zinc specimens. In the case of the tropical wet tests, the volume of white corrosion was heavier, but the appearance of the rusting not so early in the test cycles as with the tin/zinc specimens.

Cadmium coatings are dealt with in Tables VI and VII. The salt-spray results are similar to those for the zinc coatings, only the very thin cadmium coatings (sample No. 2) showing marked rusting. Under the cyclic wet tests, rusting commenced at periods commensurate with the thickness of coating, all of which were relatively thin. Taking the latter into consideration, the cadmium coatings were equal or superior to the tin/zinc platings under damp conditions, and superior with respect to the development of white corrosion compounds, although inferior for rust proofing, to the zinc coatings.

In Tables VIII and IX, zinc and cadmium coatings similar to those dealt with above but chromate passivated to D.T.D. Spec. 923 are considered under the salt-spray and tropical wet conditions. Their performance under these tests is exceedingly good.

For the zinc and cadmium platings, the following process conditions were employed:—

ZINC

Electrolyte:	
Single Zinc Cyanide	10.9 oz.
Sodium Cyanide	4.5 oz.
Sodium Hydroxide	8.8 oz.
Aluminum Sulphate	1.0 oz.
Water to make	1 gal.
Temperature	25°-30°C.
Cathode Current Density	10-20 amp./sq. ft.

CADMIUM

Electrolyte:	
Cadmium Oxide	5¼ oz.
Sodium Cyanide	12 oz.
Dextrin	¼ oz.
Water to make	1 gal.
Temperature	Room (15°-25°C.)
Cathode Current Density	10-15 amp./sq. ft.

TABLE VII.—PERFORMANCE OF CADMIUM-PLATED MILD-STEEL COMPONENTS UNDER TROPICAL TESTING TO W.T. BOARD SPEC. K.110

Sample No.	Nature of Component	Thickness of Cadmium Coating Ins. × 1000		Performance under the following cycles :—				
		Minimum Local	Average	1 dry	4 wet	8 wet	12 wet	21 wet
1	Machined and pressed small components.	0·20	0·30	Unaffected.	Colour dark and considerable rusting.	Little further change.	Rusting more marked.	Colour very dark, rust on most surfaces and especially on edges.
2	Large formed component.	0·20	0·30	ditto.	Colour considerably darkened.	Some rusting in corners and bends, and on edges.	Little change.	Little change, rusting more intense, but not more extensive.
3	ditto.	0·10	0·15	ditto.	ditto, also rust appearing in bends.	Rust deeper.	Rust more intense.	Very dark and much rust in bends, edges and on inside surfaces.
4	ditto.	0·15	0·25	ditto.	Darkened and rust appearing inside bends.	ditto.	ditto.	ditto.

TABLE VIII.—PERFORMANCE OF MILD-STEEL COMPONENTS, ELECTROPLATED AND CHROMATE PASSIVATED (D.T.D. 923) UNDER SALT-SPRAY TEST

Sample No.	Nature of Plating	Thickness of Metal Coating Ins. × 1000		Nature of Component	Period of Salt-spray Test in Days		
		Minimum Local	Average		1	14	28
1..	Zinc.	0·3	0·5	Flat panel.	Unaffected.	A few black spots.	General whitening, but very slight and most intense at edges.
2..	Zinc.	0·3	0·5	Large formed component.	Unaffected.	ditto.	ditto.
3..	Cadmium.	0·4	0·62	Flat panels.	Unaffected.	Unaffected.	Slight darkening in a number of areas, no corrosion and condition very good.
4..	Cadmium.	0·20	0·30	Formed components.	Unaffected.	Unaffected.	ditto.

TABLE IX.—PERFORMANCE OF MILD STEEL COMPONENTS, ELECTROPLATED AND CHROMATE PASSIVATED (D.T.D. 923) UNDER TROPICAL TESTING TO WT. BOARD SPEC. K.110

Sample No.	Nature of Plating	Thickness of Metal Coating Ins. × 1000		Nature of Component	Performance under the following cycles :—				
		Minimum Local	Average		1 dry	4 wet	8 wet	12 wet	21 wet
1	Zinc.	0·30	0·60	Miscellaneous small machined components.	Unaffected.	Very slight whitening at edges.	Slight increase in whitening.	Slight increase in whitening.	Exceedingly light white corrosion film on 50% of surfaces, no rusting, condition very good.
2	Zinc.	0·40	0·80	Large formed components.	ditto.	ditto.	ditto.	ditto.	ditto.
3	Cadmium.	0·20	0·30	Large formed components.	Unaffected.	Unaffected.	A few dark patches.	No change.	No change, condition very good, no corrosion and no rusting.
4	Cadmium.	0·30	0·60	Miscellaneous small machined components.	ditto.	ditto.	Unaffected.	Unaffected.	A little darkening in colour, generally unaffected.

The chromate passivation was applied to the zinc and cadmium-plated parts while still wet from the washing after plating, and consisted of immersion for 5-10 seconds at room temperature in the following solution:—

Sodium Dichromate Crystals	2 lb.
Sulphuric Acid	1 fluid oz.
Water to make	1 gal.

The passivated work was thoroughly washed in cold water, and then dried off from warm water at a temperature not exceeding 60°C.

Soldering and Resistance Welding

The finishes discussed are of particular interest to the light electrical industries. The standard electroplate coating for the protection of iron and steel in the tele-communications industry is zinc, while the radio industry generally prefers cadmium. The reasons for this last choice are, first, good resistance to damp conditions without lacquering or enameling; second, ease of soldering. Electrical connections using soft solder must be made with a non-corrosive resin flux. Chloride fluxes, which cannot be washed off finished components or assembled apparatus, are prohibited because of the corrosion promoted by them. Under these conditions, zinc or passivated zinc cannot be soldered. Cadmium plate is easily solderable; passivated cadmium is only a little more difficult than cadmium itself.

(*Concluded on page* 62)

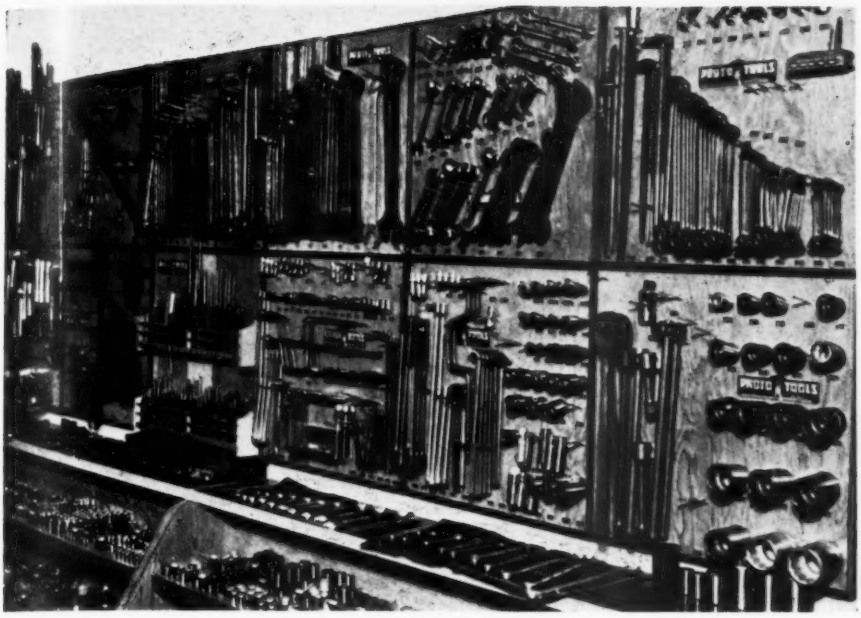


Figure 1. Typical display of the Proto tool line, with most of the units chrome plated.

Production Chrome Plating of Hand Tools

By Fred M. Burt, *Los Angeles, Calif.*

THE Proto line of tools, numbering more than 1,250 standard items and hundreds of special tools, includes sockets, attachments and sets in six drive sizes; several styles of wrenches, including large industrial types, and a large variety of pullers, screwdrivers, pliers, hammers, body and fender tools, engine tools, feeler gauges, bars, punches, chisels, plumbing tools, tool boxes and chests. See Figure 1. These fine mechanics hand tools for an infinite variety of industries and applications, are sold all over the United States and throughout the world.

The company, with its main plant in Los Angeles, is one of the world's largest manufacturers of high-quality hand service tools. The company also has a large Eastern factory at Jamestown, N. Y., and two wholly-owned subsidiaries, The P. & C. Hand Forged Tool Co., Milwaukie, Ore., and the Penens Corp., with a factory near Chicago.

At the main plant in Los Angeles, the plating department, under the supervision of *Kenneth Midling*, General Foreman, started operations in 1947, is fully modern, and is operated in an extremely efficient manner, regardless of percentage of capacity employed, and with close control of every cost factor.

In the production of "Proto" tools, the last manufacturing operation on almost all of the units produced is that of chrome-plating. Wrenches serve as a good example for describing and illustrating the various operations involved in plating Proto tools. They are moved away from the polishing line (Figure 2) in specially designed, portable racking tables. These tables have wooden 36" x 27" containers 8" deep in front and 15" at the back. They are mounted on a welded steel angle frame which includes four 5" wheels and 7" clearance for lift truck forks, used for delivery to the plating department.

Figure 2. Polishing box and open end wrenches on 16" wheels. Note special tables into which wrenches are placed to be carried to the plating department.

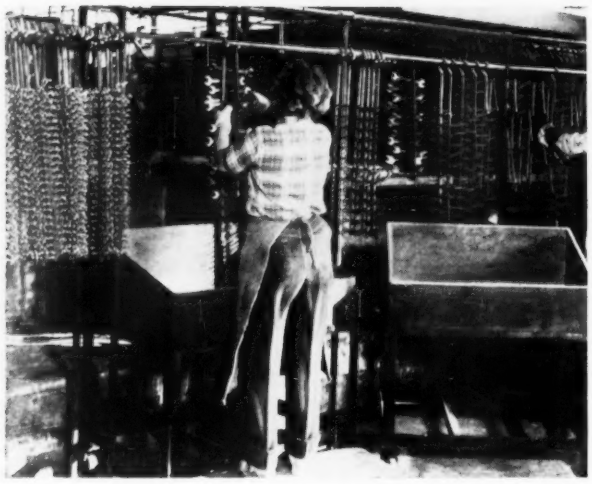


Figure 3. Racking up wrenches and other tools in the plating department.

These tables were designed for the maximum of convenience in supplying tools to the rackers in the five racking stations, Figure 3. The pipe stanchions that hold the racks are located at the end of a wooden platform in the main room of the plating department. There are nearly a thousand copper racks in regular production, in different sizes and designs, principally for sockets, ratchet parts, wrenches and screwdrivers. In preparing these racks for use, they are first given a prime dip and bake, followed by a dip in a rack coating plastisol, followed by another baking.

The racked parts first go through a three-stage cleaning operation:

1) Solvent emulsion degreasing used only on work showing a plainly evident grease deposit. A cold water rinse follows this step, if used.
2) Boiling alkaline cleaning solution, then hot water rinse.
3) Semi-automatic, reverse current cleaner tank.

Next, in the middle of the platform, between two nickel-plating lines, are the six tanks in the copper strike line, Figure 5. The smaller nickel-plating unit at the left is not visible, but is used when production is very heavy to supplement the larger unit. This copper strike line includes the following steps:

1) Warm water rinse tank.
2) Hydrochloric acid dip (20% solution-unheated) to eliminate alkali carry-over from cleaning.
3) Cold water rinse.
4) Copper strike, 3-4 mins.
5) Cold water rinse.
6) Sulphuric acid dip (10%—unheated), then back to 5) for rinse.

Upon leaving tank No. 6 the wrenches are nickel plated in a semi-automatic, 42" x 20 ft. tank. Racks are loaded at the forward end, and make a complete travel of about 38 ft. to the other end and back for unloading. The time cycle varies on different units, between 8 and 15 minutes, with the conveyor having a variable speed drive.

Other warm or hot baths are heated by steam coils, but the nickel tank has a heat exchanger. To maintain an average heat of 130-140°F. in the nickel solution, a pump draws the solution out of one end for constant circulation through the exchanger. The exchanger is equipped with pure nickel tubes running through the middle of two insulated steam pipes. The solution then goes through a continuous electrolytic purification tank where impurities are plated out, and then back into the plating tank. At the end of the nickel plating tank is a reclaim rinse tank and then another cold water rinse.

From here the racks of tools are transferred to one of the chrome-plating tanks, Figure 6. At the ends of the chrome tanks are a reclaim rinse tank, a spray rinse, then hot water rinse tanks, from whence racks of finished chrome-plated units are hung above the unracking table.

De-Ionized Water Used

The elimination of sawdust or any other drying-polishing medium to produce spot-free plating is effected by the installation of a cation-anion exchanger for mineral-free water with a capacity of about 10,000 gallons of de-mineralized water (about two weeks supply) between regenerations. See Figure 7. Besides being used for the last hot water rinse on plated units, the mineral-free water is used in the makeup of the two alkaline cleaning solutions. This enables the use of a cleaner compound that is simpler and about 50% less expensive than when additional chemicals were required to compensate for the undesirable minerals in the water. This "soft" water is also used for copper, nickel, and chrome plating makeup and additives, to provide a superior plating solution completely free of water-borne minerals.

Along the wall, close to the end of the plating line there is a tank for caustic stripping solution used on all racks after plated units have been removed, with a cold water rinse tank nearby. The racks are then placed on a special, welded steel rack which is used to carry them back to the racking area to be used again. Beside the rack strip tank is a nickel strip tank and hot water rinse.

On the other side of the wall are the dip tanks for

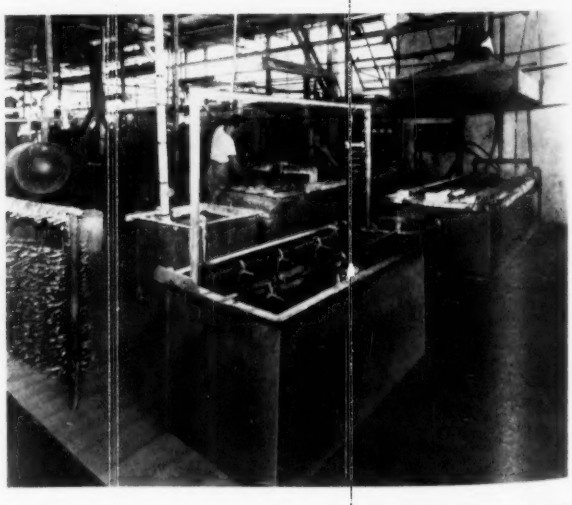


Figure 4. Cleaning tanks; first row, left to right—solvent degreasing, water rinse (round tank), hot alkaline cleaner; second row—hot water rinse and semi-automatic reverse current cleaner tank.

application of rack primer and plastisol coating. Spray work is also done in this small room.

In the middle of the third (least-used) plating line, on the edge of the platform, there is a 4′ x 12′ x 5′ deep, rubber-lined tank, used for storage when plating solutions are filtered with a portable filter. Under the platform there is a shallow cement reservoir with two sumps and piping to the main sewer, used for dumping of solutions. Along the inner edge of the platform there is an 8′ wide truckway, with pins for rack storage on the wall at the end toward the racking tables. Thus, every square foot of area is used to good purpose, and a high standard of "good housekeeping" is maintained.

This setup can be operated with high efficiency and low costs whether at virtual capacity—around 30,000 pieces daily (eight hours) with six rackers, one cleaner, two on copper and nickel plating, two on chrome-plating, two unracking, one rack stripper, and one on rack and other maintenance, a total of fifteen—or at, say, a production of 18-20,000 pieces daily, with a crew of eight.

Foremen's Incentive Plan

In the first paragraph of this article, mention was made of the close control of every cost factor. This control is plant-wide, and its maintenance, plus the Foremen's Incentive Plan, are two of the major factors in keeping production costs at the lowest minimum compatible with the manufacturing of quality products. In general, only the departments where it is possible to measure output accurately are included in the Foremen's Incentive Plan. The cost standards in the plating department are based on time studies to determine the production cycle total for each individual item.

This plan is simple and easily understandable. It requires very little work to administer, and no data not conveniently available. The basis is the actual, overall controllable cost of a unit of production, and all results are relative to the month before. That is, last month becomes the bogey for this month.

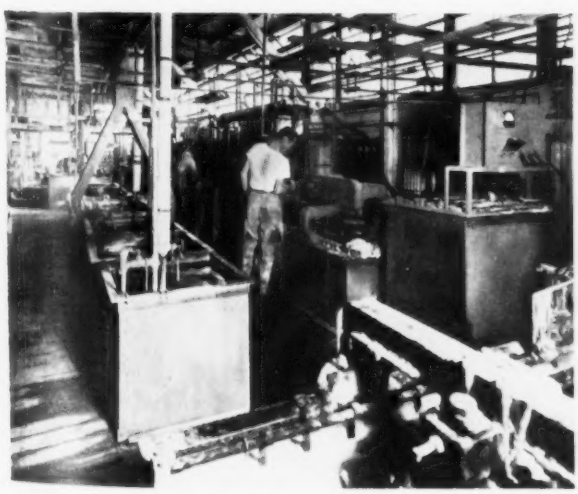


Figure 5. At left are the six tanks in copper strike plating line—(1) water rinse; (2) hydrochloric acid dip; (3) water rinse; (4) copper strike; (5) water rinse; (6) sulphuric acid dip. At right is purification unit on the end of the semi-automatic nickel plating tank, with heat exchanger above it.

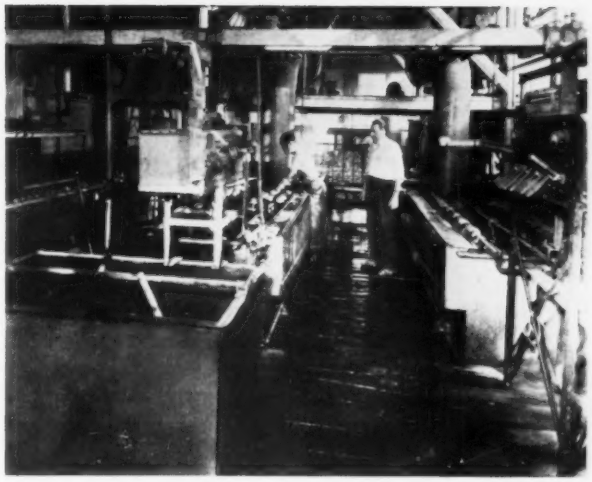


Figure 6. Three parallel chrome plating tanks. Storage tank at left is used at times when work may pile up ahead of the plating. General Foreman Kenneth Midling is at right. A floor level spray from pipes at plating tank bases keeps plating solution drip washed away to prevent unsafe "slick" condition of platform.

Controllable costs within any given department are approximately 67% Direct Labor Utilization and 33% Indirect Labor Plus Factory Supplies. Added to the actual direct labor cost is the following; indirect labor, labor used for general repairs in a department, allowed time, overtime premium, and factory supplies. Overall cost of producing a unit this month is compared with the overall cost of producing the same unit last month. This is the basis of the Plan in its simplest form.

Following are the elements involved and the methods of computing the bonus:

(A) Maintaining

For maintaining last month's costs within 20 points in his department, the foreman receives a flat 5% in the bonus column. (In designating the cost of a production unit, the cost is stated in decimal parts of a dollar carried to the fourth place—such as .0790. One point is one ten-thousandth of a dollar, or one in the fourth place.) Thus, it can be seen that a very slight increase in costs will cause the loss of the bonus for "maintaining."

(B) Suspension

To prevent a foreman from receiving consecutive bonus payments (maintaining within 20 points) while costs rise successively each month, a 60-day limit is placed on the upward trend even though it may be very slight. If the trend doesn't start downward on the third month, the foreman is automatically suspended from the Plan, both departmental and general factory. He is eligible for reinstatement when his costs again start downward.

(C) Reducing

When a foreman reduces his costs, he receives a .2% addition in his bonus column for each point he decreases the cost of the unit, or 1% for each 5 points in cost reduction.

(D) Housekeeping

There is a penalty factor applied to any foreman

Figure 7. At left is the six-tank water de-mineralizer unit. Girl in background is spraying interiors of certain tools; back of unracking tables are stripping tank and rinse for racks (with rack carrier at left) and nickel stripping tank and rinse bath.

who allows poor housekeeping to exist in his department. The factory is inspected at an unannounced time each month, by each of the members of the Housekeeping Committee (Chief Engineer, Plant Engineer, and Chief Inspector). Three grades of Plant Good Housekeeping have been established. "A" grade carries no penalty, but for "B" grade there is a 1%, and for "C" grade a 2% deduction penalty in the bonus column.

(E) Safety

A plus or minus factor for safety is based on severity and frequency figures as compiled each month by the Safety Engineer. If either frequency or severity is reduced this month over last, the foreman receivs 1% for each in his bonus column. For an increase in either he is penalized 1%; thus he can have a maximum of 2% added to, or substracted from his monthly bonus. These bonuses or penalties are very infrequent as safety standards are very high in each department, and accidents are unusual.

(F) Factory Average

In order that every General Foreman may be rewarded for both the specific results of his own efforts in his department, and for the effects they will have in the overall plant costs, a bonus on the Factory Average is part of the Plan.

1) For maintaining within ten points, a flat 5% is added in each General Foreman's bonus column.

2) For decreasing costs, 0.2% is added for each point of reduction in each General Foreman's general bonus column.

The application of this Plan has been one of the chief factors in effecting substantial cost savings, and keeping them down. It places all controllable expenses under incentive control, and completely integrates the theory of incentives throughout the manufacturing division. The operation of the Plan in the manufacture of Proto Tools is another proof that properly designed and applied incentives can hardly be surpassed by any other single factor in the development of top manufacturing efficiency.

ELECTROPLATED TIN-ZINC ALLOY

(*Concluded from page* 58)

The tin/zinc alloy platings are readily solderable, and the chromic-acid filming does not impair this facility. The only other comment to be made on the solderability of tin/zinc alloy is to the effect that if in bit-soldering, the iron is rubbed to and fro several times in making the junction, the zinc constituent causes a scum to rise on the solder, affecting the neatness of the junction, rather than its efficiency.

The remarks made on the solderability of these plated coatings apply also the coatings after submission to 6 or 8 wet cycles of the K.110 tropical test, indicating that plated components can be stored for very considerable periods and still retain their soldering qualities.

Another important feature, especially for radio and many other types of electrical components, is suitability for resistance welding. Chassis, frames, basec, etc., may be fabricated by spot-welding, and the component parts are electroplated before the joining operation, otherwise electrolyte is retained in the overlapping junctions. The welding of coated steel is more difficult than plain mild steel. Higher power must be available, closer control is required, troubles arise from pick-up of the coating by the electrode and from sticking of the electrode to the work. Vaporization of the coating with resultant sputtering or "blow-out" from the welded spot may also be experienced.

Under the present subject, it is not opportune to discuss the methods of determining spot-weldability, but it is apt to quote comparative mertis, as far as they are known to date:—

With zinc plating, up to 500 welds can be obtained before re-cleaning of electrodes is essential. The welds are sound, of good form (lozenge shaped in cross section), and of strength 800-1,100 lb.

With cadmium plating, sound welds of good shape and strength (1,100-1,200 lb.) can be obtained, but due to serious pick-up and sticking, up to 50 welds only can be obtained before retrueing the electrodes.

With tin/zinc alloy platings, only a restricted amount of work has been performed. Strength of welds is very good (1,800-2,000 lb.). Sticking troubles are pronounced at the start of the run but rapidly improve, and the indications are that tin/zinc will respond to spot welding as well as zinc plating itself. Despite the high-strength value of the welds, rather poor shape (in cross section), "earing," cavities, and porosity are encountered. Further experience is required to eliminate this apparent defect.

The tin/zinc alloy platings are relatively new to industry, and extended usage is required before they can be fully appreciated in their proper perspective. The data presented in the foregoing is limited, but it establishes tin/zinc in a similar position to zinc and cadmium for the protection of iron and steel components, close to cadmium for resistance to damp conditions and ease of solderability, and superior to cadmium and close to zinc for spot welding.

All Our Yesterdays—Part XIII

By Frederick A. Lowenheim

THE year is 1915. America remained, to employ a cliché, an island of peace in a world at war, but how long it could maintain its precarious neutrality was a question. Both the allies and the central powers were blandly ignoring our State Department's conception of international law: Britain was enforcing an "illegal" blockade of Germany, and Germany's submarines were sinking our ships in increasing numbers. Our own citizens, moreover, perversely denied themselves even the consolation of alcohol, as more and more states enacted prohibition statutes. The war in Europe was beginning to settle down into that murderous stalemate of trench warfare which made it, from the standpoint of the common soldier, probably the most miserable conflict in history. On January 19 occurred the first serious German air raid over England. German espionage was active in America, and on January 18 a fire of incendiary origin caused $1,500,000 damage to a large plant manufacturing war material for the allies: the first in a series of such fires. Other developments of the early part of the year included the first transcontinental telephone call on January 25, when *Alexander Graham Bell* in New York spoke with his assistant, *T. W. Watson*, in San Francisco. On February 1 the Lackawanna Railroad made the first successful test of a telegraph communication from a moving train to a station. While the State Department busied itself dispatching protest notes to England and Germany over violations of our neutrality, our citizens made two moves to promote peace: on the international scale, by the formation of the League to Enforce Peace, with ex-president Taft at its head; and on the domestic scene, when the state of Nevada enacted a law making it easy to obtain a divorce.

For the most part, the journals of the plating trade ignored the war and its impact on America, preferring to treat matters of immediate technical or professional interest. The secretary of the Electroplaters' Society reported on progress during 1914: " . . . At the beginning of the year there were fourteen chartered branch societies. Two more have been added during the year; Bridgeport received its permanent charter in July, and Cleveland, at present working under a temporary charter, was organized in November.

"Much has been accomplished during the year in education. Bridgeport and Newark branches have installed laboratories for the use of their members in making chemical and electroplating tests and experiments. Buffalo, Chicago, Rochester and Toronto have engaged instructors to give instruction in chemistry. The St. Louis branch has prevailed upon the Board of Education of St. Louis to provide a course in chemistry, especially devoted to electroplating, in the night schools. The Dayton branch has instituted a series of lectures on electro-chemistry and allied subjects."

The Electroplaters' Society was becoming more and more important to the members of the trade, and some began to look to it as a central agency for establishing standard plating practice throughout the industry. Thus:

" . . . What is really needed more than anything else at this time in the way of real help to all platers is the standardizing of all plating solutions, similar to the Electrical Engineers' Association has in its wiring, etc."

The subject was considered in an editorial, which concluded: "Obviously the first thing to do in starting on a campaign of standardization, is to tackle the question of the purity of the chemicals used in plating operations. We hope that it will not be long before we have the pleasure of publishing a set of 'standard specifications for electroplaters' chemicals'."

A correspondent was not sanguine about the prospects, for reasons which he set forth at a length which forbids any but very inadequate quotation: "Under the present conditions standardization is impossible, and for this reason: there is a lack of co-operation among both the employer and the foreman. This has to be overcome before there is any attempt made to do any work on standardization that is worth while. A large number of foremen have come to the conclusion that the last thing they should do is to go to the boss with anything that looks like a case of spending money.

"To cite an instance . . . say a foreman goes into the office with a requisition for anodes, any kind at all but iron (some even have trouble getting these), but for our example we will say nickel, at about forty-five cents a pound. The purchasing agent, superintendent, or manager, whoever it may be will look at it and, as a rule say they will attend to it, or anything, to put it off. If the plater happens to be timid or has confidence in them he will go back to his department trusting that he will have new anodes." The story ends, of course, with the plater being told to purchase double nickel salts instead of anodes because they are cheaper, per pound!

The same correspondent returned to the fray several months later with a plea that as a beginning towards standardization in the plating room the plater should adopt the metric system. Oh, well . . .

And a final note on Society affairs: "The third annual convention of the American Electroplaters' Society which was held this month (June) at Dayton, Ohio, deserves more than ordinary mention. The

HOW THE CITY OF DAYTON ADVERTISED THE ELECTRO-PLATERS' CONVENTION

The flags are raised today in honor of the Convention of the
AMERICAN ELECTRO-PLATERS' SOCIETY
which is being held in the Hall of Industrial Education, June 3rd to 5th.
The Society is organized for educational purposes. All meetings here are open to anyone interested in electroplating.

The City of Dayton was gayly bedecked as above in welcome to the delegates of the Third Annual Convention.

most noticeable thing was the great interest which the delegates took in the various papers read and the discussions of these papers. The paper on "Electroplating with Cobalt" attracted particular attention, because the subject presented was what might be termed the latest development in the industry, and one which is attracting considerable attention at this time among many members of the electroplating fraternity." Cobalt plating was indeed the subject of many articles and papers during this period, but apparently the process never lived up to the high hopes with which it was launched.

You never know what you may learn by reading an article on plating methods. For instance, this historical note from a paper on barrel plating: "The earliest use of the tumbling barrel on record was that carried out by violent lovers, who put their hated rivals inside of barrels lined with sharp steel spikes and rolled them to the bottom of the hill, thus ending in a satisfactory and spectacular manner the future rivalry from the individual so treated . . ." Not a word, unfortunately, as to how you lure the guy into the barrel.

And you might learn first-aid methods: "A process of extracting poisonous metals, such as lead, copper, arsenic, antimony, silver and mercury from living bodies, and thus preventing metallic poisoning, is a recent invention. The method is electrolytic, the two poles of a source of current being connected to liquids into which are immersed *separate* parts of the body; the part chiefly affected is in contact with the liquid connected with the negative pole. In the case of lead poisoning, the feet are placed in a bath of water containing a little common salt, and a metallic plate connected with the positive pole is put in the bath; the hands are put in another bath connected with the negative pole. On passing a current, which may be about 20 volts, the lead is deposited in the negative bath." It occurs to me that the inventor didn't go far enough—he was on the track of a cure for laziness. All the subject would have to do is sit down in the solution.

The journal which printed the following item made no comment; the editor did not say he disbelieved it, though: "An explorer of Asiatic Russia is reported to have returned from his explorations with news of a remarkable metal, samples of which he brought back with him and had analysis and experiments made by chemists in Moscow. Among the properties claimed for this metal is the following: in the presence of an acid it generates such an excessive degree of cold that the glass vessel containing it is immediately reduced to powder. Similar results followed when an iron vessel was used for the purpose, even when current was used. The latter [what, the current?] was suddenly decomposed without either an explosion or emanation of gas, but with a stupefying lowering of the temperature. [Stupefying is the word.] The unknown substance is said to be an opaque pasty mass, quite heavy and so found lying among mica and other minerals."

As in former years, noted in previous articles of this series, the plater of thirty-five years ago occasionally found the irritations and frustrations of his job more than human flesh could bear in silence; taking pen in hand he found catharsis by writing to his trade journal. This example is entitled "Poor Plater! by One of Them":

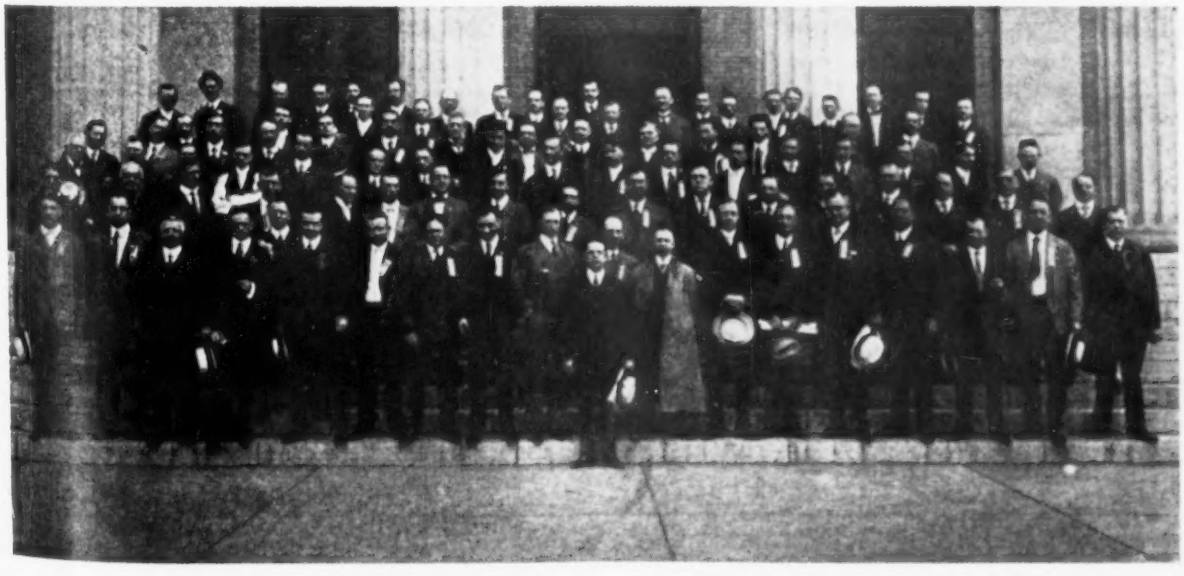
"Think of the thousands of plating rooms in the country, no two alike. I shall describe two types that I know well. The first is clean and nearly as sanitary as it can be made, with plenty of windows for the admission of good daylight, clean running water, good cleaning solution, well warmed. It has the latest improved dynamos, rheostats, voltmeters, ammeters, drying bins and ovens, racks and wire, plenty of chemicals, tons of anodes of all kinds, blowers to remove foul air and fumes, in fact everything necessary to do good work. The second room is dirty and foul smelling, and never had daylight. Iron gaspipe carries the current from old second-hand dynamos to the tanks, and there are no rheostats, voltmeters or ammeters; chemicals are bought just as you use them; there is one cold water tank for going in and out of brass, copper and nickel solutions, potash and cyanide, acid dips and pickles. With all these disadvantages, the article plated in this latter room is expected to be as good in color and finish as in the first. The goods are plated in a dark room, but are taken to the bright

est light for inspection. When improvements are finally decided upon, the superintendent will often take the matter into his own hands entirely, without consulting the plater. All he (the plater) gets is the blame when things go wrong. Make a wooden tank for a silver solution and put white lead in the joints; when the cyanide takes up the lead and all the silver is black or dark brown, blame the plater! Line a tank with sheet lead for a hot cyanide copper . . . Blame the plater! Line it with pitch and the hot solution will run it all to the bottom. . . . Blame the plater! Put an acid copper solution in an iron tank and spoil the solution. Use a galvanizing solution in a tank for a year or so, then put in a nickel solution, turning it black. . . . Blame the plater!"

And in the same vein, the fallacy of cheap help in the plating room was the pet peeve of another correspondent: "In these days of industrial stagnation we often hear manufacturers remark that they will be compelled to retrench, and this retrenchment usually starts by lopping off some of the high salaried men. This is particularly true of the foremen of the plating departments. It seems that plating is being regarded as a very simple process, that a few formulas, fair equipment and a book on plating are all that is necessary for a boy to have in order to turn out the work. The superintendent decides that there is no need for a foreman plater under present conditions, and further decides that as he had not so much business to look after as formerly he can place the tank man in charge of the plating room and give him a boy to help him, thus cutting down the overhead expense. His foreman plater had made a life study of electroplating and had his processes figured to the highest efficiency. He had studied chemistry, going deep into its secrets, and knew what he was doing. He had eliminated the necessity for scrubbing and had long ago dispensed with the help which had been required for that purpose. He had discovered that the electric current must be figured as an element and that a certain percentage of unsaturated water must be present in his solutions to get the best results. He had discovered the cause of 'peeling,' 'burning,' 'pitting,' 'spotting out,' 'streaking,' and the innumerable defects of electrodeposits and had remedied all this." (This foreman, in other words, was a genius.)

So, he lost the job, and the plating room was turned over to green help, thus saving the foreman's salary of thirty dollars a week (that's what it says). And "the solutions had changed under the tension of rush orders and were beginning to behave differently. Considerable work was being repolished and replated. The brass and bronze were off color: the nickel was pitted; all the cyanide, the copper salt, the nickel salt and the supplies which had usually lasted three months had disappeared and more were ordered; conditions were growing worse. Where was the economy?"

We digress for a moment to catch up with the news of the day. On April 30 *President Wilson* created Naval Oil Reserve No. 3 near Casper, Wyoming. Those of my readers over 35 might recognize this event by its popular name, *Teapot Dome*. On April 29, the German foreign office bought space in American newspapers to warn American citizens against booking passage on the *Lusitania;* that the warning was no idle threat became clear on May 7, when a German submarine sank the Cunarder, with a loss of 114 American lives. Wilson protested on May 13; on the 28th Germany replied that the action was justified because the *Lusitania* was armed, which the British promptly denied. Partly because of disagreement on the handling of the *Lusitania* affair, *Bryan* resigned as Secretary of State and *Robert Lansing* took over. On July 2 a bomb exploded in the Senate reception room, and the next day *J. P. Morgan* was shot and wounded by the same German who had planted the bomb; the would-be assassin then committed suicide. Notes continued to pass, and it was becoming more obvious every day that the question was not would we go to war, but rather, when? On July 24 occurred another in the long line of excursion steamer disasters, when the *Eastland* capsized at its pier in Chicago and 852 people were killed.



Delegates and visitors to the Third Annual Convention of the A.E.S. at Dayton, Ohio in June 1915.

The journals of the plating trade, meanwhile, were featuring articles on Chemistry for Platers; on Cobalt Plating, Brass, Silver, Copper, Gold, and all the other familiar processes. Without a doubt the most active subject, and the one which evoked the most controversy, was that of nickel plating. This topic brought forth contributions from the leaders of the profession, men like *Charles H. Proctor* and *Dr. Oliver P. Watts.* And a new note was struck: the possibility of bright plating of nickel. Thus: "Bright nickel plating salts have claimed the attention of the plater for a considerable period. On their first introduction the plater was very much interested, but at the present time the interest seems to be on the wane as there are so many of these salts upon the market it is somewhat difficult to decide which of them will give the best results. The basis of the various bright nickel salts is no doubt nickel ethyl sulphate. A German patent was granted in 1905 covering this compound. The ethyl sulphate combinations brought forth such prepared German salts as Mars, Lipsia, Germania and Neptune salts for the production of dense bright nickel deposits of unusual thickness. The foreman of a plating department in a large plant who installed bright solutions found it was possible, after the initial solutions were in use for some time and needed replenishing, to use nickel and magnesium sulphate and a small amount of sulphate of ethyl for the purpose. This . . . may bring up the thought that this material might be used as a brightener for nickel solutions of ordinary compositions. The writer noted that, in some plants, connected to the positive pole of the nickel tank were a number of small metal rods about nine inches long and three-eighths of an inch in diameter that had the appearance of being composed of zinc. Inquiry showed that these were used for brightening the deposit. The small metallic sticks, which the writer afterwards found to consist of cadmium, were left in the solution over night and removed the next morning. Just what action the cadmium could have upon the solution of nickel is somewhat difficult to explain. Cadmium, like zinc, produces hydrogen in the presence of dilute acids and it might possibly be that the continuous evolution of hydrogen in the bath, when not in operation, may have a beneficial influence upon the solution, acting as a clarifier. The writer goes on to point out that this hydrogen theory is probably true because other plants have obtained similar results by using iron and zinc, in analogous ways. But it appears that the effect of cadmium may be specific also, for one bright nickel solution reported from the field has the following composition:

Cadmium Chloride	16 oz.
Nickel Sulfate	16 oz.
Boric Acid	8 oz.
Sodium Chloride	2 oz.
Water	3 gallons

This is added to 200 gallons of a standard nickel solution.

The subject of nickel plating was approached in a different manner by *O. P. Watts,* speaking before the annual banquet of the Chicago branch, AES: " . . . For many years it has been the practice of the makers of anodes in the United States to add to the nickel varying amounts of iron, carbon and tin, so that the resulting anode contained only about 92% of nickel. The following formula for making nickel anodes is taken from one of the plating trade journals: Nickel 92%, tin 4%, old files 4%. Why old files are preferred to any other form of iron is not stated. These impurities in the anode are of no benefit either to the solution or to the nickel plate, and their presence in nickel solutions should no longer be tolerated. For a number of years European platers have been using anodes containing 98% of nickel, and it is time that American platers followed their good example. In a solution containing only sulphates these pure anodes do not corrode well, but the addition of one or two ounces per gallon of a soluble chloride remedies this trouble. Another improvement in nickel plating which has come to us from Europe is the high-power nickel solution. It may be profitable to consider for a moment what constitutes a high-power nickel solution. It is not some mysterious chemical of wonderful potency, but is merely a solution containing much more nickel than the old style bath, and which therefore permits of using a greater number of amperes per square foot of plated surface without causing a burnt deposit. There seems to be a prejudice on the part of many platers against strong nickel solutions, as indicated by such statements as the following: 'A new bath composed of double sulphates and water not infrequently gives trouble from peeling in addition to the dark color, especially if the solution stands in excess of 6° Baume. To remedy, reduce the density to 4½ or 5° and add the conducting salts.'

"Today many platers are paying 35 cents a pound for an imported mixture of unknown salts, making solutions having a density of 16°, and obtaining extremely satisfactory results from these dense solutions. It is time that platers recognized that poor nickel deposits are due to some other cause than too dense a solution. I have tested but one of the high-power salts now on the market, but for a period of two months this has done all the dealer claimed for it. I cannot conceive that a plater who has once tried this salt would never use the old double sulphate solution. It must be admitted that the expense is great . . . Only when the composition of these salts becomes known, or platers discover equally good combinations of salts themselves, will the high-power solutions compare favorably with the old style solution as regards cost per unit output. There are several methods of making a dilute solution do the work of a concentrated one. One method is to circulate or stir the solution, or to move the object. Another, and more effective way of transforming an ordinary dilute nickel plating bath into a highpower solution is to heat it."

A series of three questions-and-answers, from three issues of the same journal, illustrates an interesting editorial change of heart, or mind. Here's the first: "Q: Please state ingredients and quantity for good nickel solution for nickel bath. A: Water, 1 gal. double nickel salt 8 oz.; single nickel salt 1 oz.; sal ammoniac 1 oz.; boracic acid 6 oz. Use hot water in making up the solution, but solution must be cold when plating."

The second: "Q: Please advise how many pounds of double nickel salts to use to a vat that holds 250 gal. of solution, or how many ounces to the gallon? A: The best formula for nickel plating is as follows: Water 1 gal., double nickel salt 8 oz.; single nickel salt 1 oz.; sal ammoniac 1 oz.; boracic acid 6 oz. Have water hot in making up, but use solution cold. Follow this and you will have no trouble."

And the third: "Q: A recent issue contained this formula: (see above). We made up this solution, 6° Baume, which gave good silvery deposit on the first run, but subsequent work was unsatisfactory. A: The nickel solution can never be made to work in a satisfactory manner. The cheapest thing to do is to make a new one. A more satisfactory nickel solution than the one given consists of: double nickel salts 10 oz., sulphate of nickel 2 oz., epsom salts 6 oz. Dissolve the salts in the solution in the order given."

Editorial slips like that were grist for the mill of rival journals, and another trade paper lost little time in taking notice of this and other inconsistencies. A correspondent also joined in the fray, and took the editor to task for handing out alleged misinformation:

"To The Editor: I note in a trade journal that is supposed to guide others, some answers which I cannot exactly comprehend. I am wondering whether the answers are really intended to be taken seriously or are really jokes. Here are the questions and answers; see for yourself and then have a good laugh:

"'(1) How much soda do platers put in a brass or copper solution, and why? Answer: Soda serves for the preparation of metallic carbonate and for freeing objects from grease.'

"'(2) What is the right way to take care of a nickel solution?

"'Answer: To care for a nickel solution it is best to make a new one when the old gives poor results.'

"These are only samples. 'A Successful Brown Finish on Brass,' after two long columns of symbols, ends up by saying 'Paint it Brown!'"

The affairs of the Electroplaters' Society came in for further editorial notice which may be of interest: "A feature of this convention (at Dayton) which is to be commended is the decision of the committee to charge a small fee to the delegates and attendants to cover the expense of the convention. This is as it should be and no one will object as it eliminates the possibility of being under obligations to some local organization whose resources might be strained. The practice of raising a fund by the local association of the convention city is getting to be onerous, and a convention should in this sense be self-supporting. The small fee charged will not add appreciably to the convention expenses of anyone attending, and at the same time will obviate the taxing of not only the local organization, but also will relieve the interested business houses of what seems to be a polite form of 'hold up,' but which is usually charged to adveritsing. This latter form of contribution should go into the discard with the menu card and program advertising."

And a change in the make-up of the organization received editorial approval: ". . . We wish to commend the passing of the amendments to the constitution and particularly the one relating to the assistant plater, which reads: 'All assistant platers who have served five consecutive years and can show a suitable efficiency in the trade can become members if vouched for and recommended by their foremen, who must be a member of the society. No establishment can have more than three members.'"

As to other matters, we must hurry over articles on the value of metal cyanides, on cleaning and plating in the same solution, on cobalt plating, and the many other subjects which engrossed the attention of the progressive plater of 1915. I want to devote what space remains to rather complete quotation of two articles on the theory of plating which represent such weird chemistry that I think you may be amused by them; and their unique flavor can be savored only by quoting them in full, or almost so. The first is titled "Plating From Hot Solutions:"

"Do solutions heated above a temperature required for holding their ingredients in perfect solution, deposit as rapidly, with the same number of amperes per unit, as do those which are worked at a temperature barely sufficient to dissolve the salts added to the solvent?

"They do not. In applying Faraday's law to the deposition of metals, we must, in order to figure the number of grams of metal deposited in one ampere hour, make the corrections for gas volumes under the different temperatures and add to the solution a quantity of salt sufficient to raise the specific gravity to the same degree under the higher temperature as that which was shown on the scale at a lower temperature.

"The writer, without any laboratory equipment, carried on a series of experiments to determine whether a warm nickel solution, saturated with the double sulphates of nickel and ammonium at a temperature of 60 deg. Fahr., would deposit as rapidly with the same number of watts flowing through when heated to 120 deg. Fahr. as it would at the lower temperature. He relied on the readings of the voltmeter and ammeter and the approximate thickness of the deposit when tested on the buff (he had no scales to weigh the deposits), and the solution efficiency as well as the current efficiency was greatly in favor of the cold solution. The correction for gas volumes was then made according to Charles' law and salt added to the hot solution until the same degree of concentration was reached, and the same number of watts per unit was used, as before. Under the new condition a deposit was formed of approximately the same thickness, and in about the same length of time.

"The next batch was plated with the solution still at 120°F., and the current density raised 50% over the former load. The deposit was obtained in a shorter time and without any objectionable features. Now, why?

"These observations lead the writer to believe that the electric element does not expand under heat when combined with other elements, and the amount of metal deposited is in proportion only to the amount of hydrogen deposited, which proves the correctness of Faraday's law as regards the deposition of metals in proportion to the amount of hydrogen evolved, but proves the same law incorrect when applied to solutions under different conditions. That is to say, we

could not compute the number of grams of nickel deposited from a solution containing the same percentage of metal and the temperature raised, when the law was based on the reaction of a solution at a lower temperature.

"If the electric element expanded in proportion to the gases of the solution under the influence of heat, then precipitation of metal would follow in proportion to the degree of temperature. Since this is not the case, we must rearrange our tables of the deposits in one ampere hour and compute from the coefficiency of temperatures, using Faraday's law as a basis, with solutions at a given temperature.

"The question may arise as to why the deposit from the warm solution is of a better grade than that obtained from the cold solution. This condition is brought about by the readiness with which the elements re-combine under the influence of heat, thus eliminating the possibility of occluding hydrogen in the deposit, or of ozonizing the oxygen. Then, too, the heat influences the solubility of the metal in its solvent, bringing it down in a finer state of division. This is demonstrated by adding sulphuric acid to the solution. The deposit will be slow and rather hard under this condition, and if the acid is added in great excess no deposit at all will be formed. But it will be noticed that the deposit is of a finer grain!

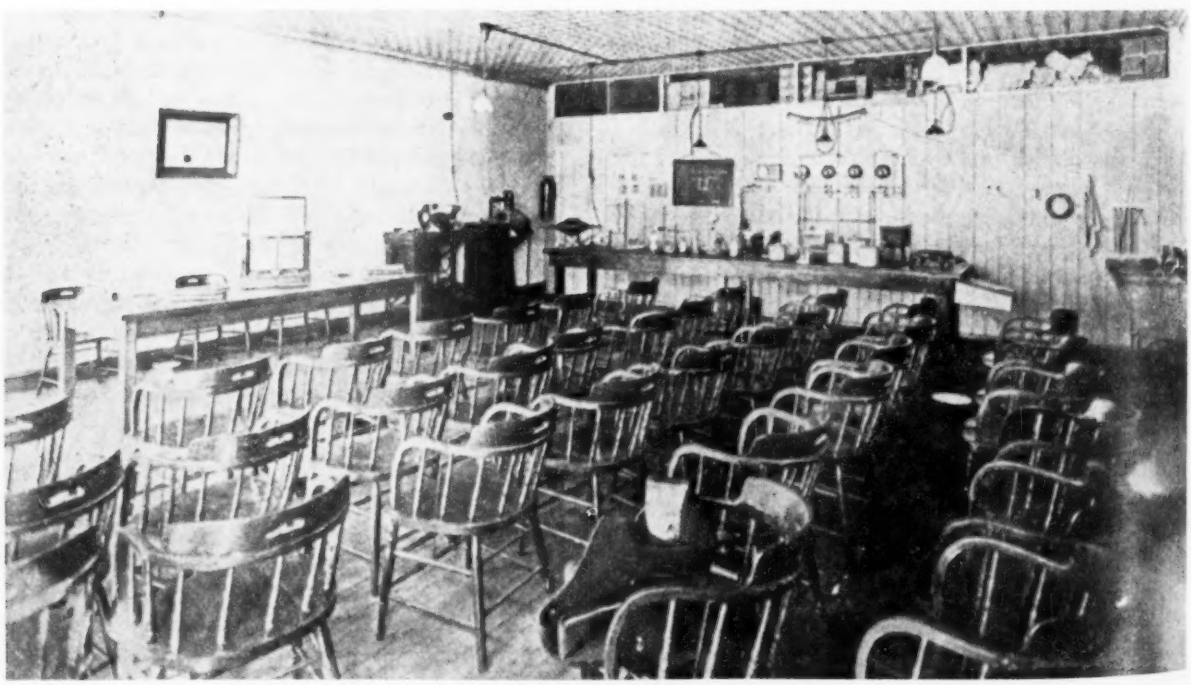
"This theory may be applied to all solvents used in electroplating. According to the above, hot solutions are beneficial only when their elements are saturated to the same degree on the hydrometer as those which are used cold, the current efficiency being the same only when the solution reaches the degree of concentration at which it will deposit freely at the lower temperature."

I trust this is all perfectly clear. If you want it explained ask somebody else: I have my own troubles. And now if you will take a deep breath, we will consider a contribution on "The Uses of Colloids in Plating Solutions":

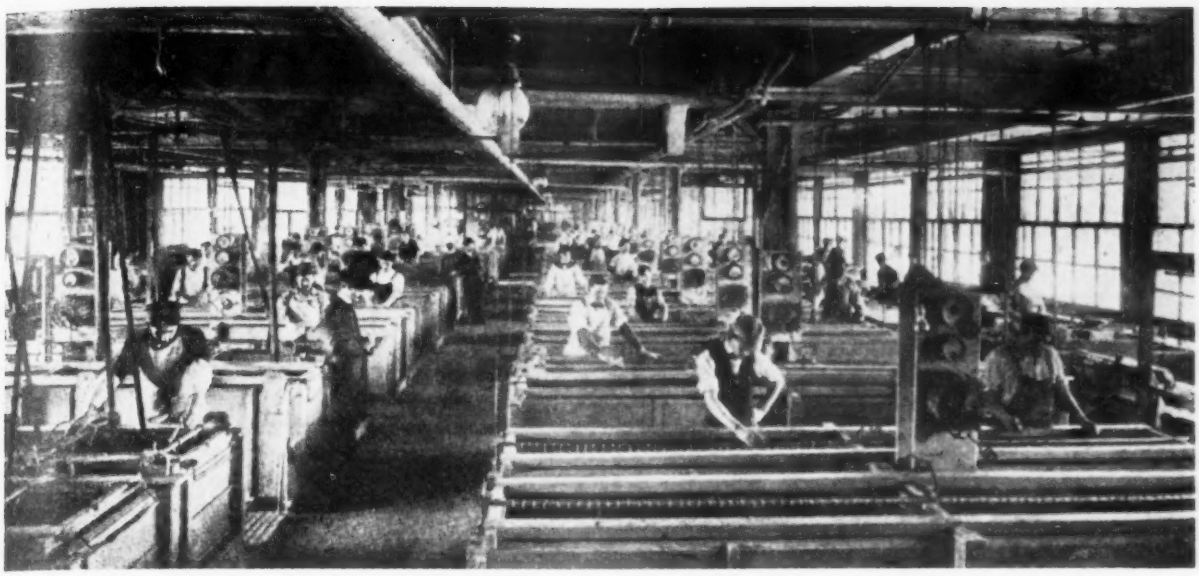
"The writer has from time to time noted inquiries as to why gelatin, glue, etc., prove beneficial to certain solutions when added to them, and as no answers were given which could be regarded as satisfactory, he undertook to solve the problem of just how the addition of the organic matter mentioned could effect any changes in a plating solution which would prove beneficial.

"It is well known that the solutions of lead and tin, when made up with caustic soda and potash as a solvent, have a tendency to crystallize and deposit as a metallic powder, even with a voltage far below that necessary to decompose the water of the solution. The crystallization of the lead and tin under the influence of the electric element is no doubt due to the catalytic force of the solvent for the salt, the electricity separating the metal from its solvent without the solvent itself undergoing decomposition, and consequently the action of the electricity was that of attaching itself to the metal by a cohesive force rather than combining with the dissolving agent or the water of solution."

The author proceeds to describe experiments on lead plating, in which without any glue only a spongy deposit was obtained; but with glue "an apparently homogenous deposit of lead was obtained in ten minutes, but when the articles had been rinsed in running water, dipped in hot water, dried in sawdust and hung out to dry, a white salt formed upon the surface, the deposit of a bluish color, which was supposed to be lead, disappearing in a few hours. It is evident from this experiment that sodium, either as hydride or in a metallic state, was deposited with the lead, and that the moisture of the atmosphere had aided in converting what lead was deposited into oxide, and the sodium into hydroxide. After repeated efforts the



Scene of the meeting room and chemical laboratory of the Newark Branch of the A.E.S., where their meetings were held in 1915.



The National Cash Register operated this large plating department, which was visited by the Convention delegates in 1915.

solution was diluted to one-third its former concentration, and the deposit showed considerable improvement, the addition of one-quarter ounce more of glue to each gallon giving a very satisfactory deposit.

"The glue acts as a filter for the lead (the glue not being perfectly soluble), preventing any crystalline substances from passing through it, allowing only the lead, which is in perfect solution, to reach the cathode, where it is deposited, not by a direct action of the current, but as a secondary reaction, the electricity combining with the hydrogen of the water and the potassium in solution, without depositing the potassium either as a hydride or in a metallic form. The glue is also a powerful oxidizer, taking up the oxygen forced out at the anode, leaving a metallic surface and carrying the oxygen to the cathode, where the hydrogen is oxidized. It will be seen that the glue performs a double duty in lead and tin solutions. The metallic content in tin and lead solutions must be so low, also the content of caustic potash or soda, that the hydrogen of the water must aid in taking up the electricity flowing into solution. If the water is anything like half saturated with caustic soda or potash their catalytic action is so great that separation of crystalline lead, together with the alkaline metal, takes place as a direct action of the current and homogeneous and adherent deposits are impossible.

"The deposition of lead and tin from caustic solutions must be a secondary reaction, and the colloidal matter must be equal to the oxygen set free. The answer, in one instance, as to how glue aided in obtaining a homogeneous lead deposit was 'It is not dissolved by the water and serves to moisten the cathode, thus removing the hydrogen.' I do not think it is possible to obtain an adherent deposit when the cathode is kept wetted. The cathode must be made perfectly dry by the decomposition of the solvent, the electricity combining with one of the elements of the solution, releasing it as a gas upon the cathode, which gas may be instantly combined with another element so that no perceptible decomposition takes place, and the metal deposited at the instant of the separation of electricity from its combination with the other element."

Well, now you know. Class dismissed.

Now for the high spots in the news. In September Germany finally promised to restrict her submarine warfare: no more liners would be attacked without warning, and without seeing to the safety of non-combatants, provided the liners did not attempt to escape or resist. As evidence that America was still officially neutral, we sent a strong note to Britain, declaring her blockade illegal and protesting her seizures of ships and cargo and her prize court procedures. In November began a series of incendiary fires in U. S. industry, aimed at curtailing our production of war materials for the allies: some of the more notable ones occurred at Bethlehem Steel, Roebling's (again), DuPont Powder Co. at Wilmington, and the same company at Hopewell, Virginia. On December 4, *Henry Ford* and a large delegation sailed on the "Peace Ship" *Oscar II* to "get the boys out of the trenches by Christmas." And while the prohibition laws passed in one state after another, the suffragettes were not doing so well. New Jersey defeated female suffrage in October, and the House of Representatives also turned it down. In November the Nobel prize in Physics went to *T. A. Edison* and *Nikola Tesla*, while the Chemistry prize went to another American, *Prof. T. W. Richards*. *Booker T. Washington* died on November 14. But thousands were dying in Europe: the bloody battle of Masuria turned back the Russian threat to Germany's Eastern front and made the world familiar with the name of Paul von Hindenburg. The Turks shocked the world by their deportations and massacres of the Armenians in April, not to be topped until Hitler made such behavior respectable. On April 22 the Germans, in the battle of Ypres, used poison gas (chlorine) for the first time, but failed to follow up the advantage the surprise had given them. Thus with no decisive advantage on either side, and with increasing misery all over the Old World, the year ended.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cleaning Rack Tips of Accumulated Metal

Question: Our plating rack tips, made of steel music wire, require cleaning off of the heavy accumulated metal at frequent intervals. At present we are hammering the tips on an anvil, but this is slow and costly. We are wondering if you know of a better method for doing this job?

E. N. L.

Answer: If the accumulated deposits are extremely heavy, hammering is about the only method that can be used. Once they have been cleaned, however, it would be easier in the long run to strip them of any plated metal after each use, so that a heavy deposit is not allowed to accumulate. A reverse current strip in dilute hydrochloric acid will remove deposits of copper-nickel-chrome. In an automatic plating machine, where the racks are not removed from the conveyor, this step could be incorporated as a final operation before reloading the racks. There has recently been introduced a chemical stripper which does not require the use of electric current, and which is claimed to strip about .001" of copper or nickel from steel per hour, with no attack on the steel. For a very heavy buildup you could leave the racks in the solution overnight. The name of the firm marketing this stripper is being sent to you.

Immersion Tinning of Aluminum

Question: We have a problem in soft soldering some copper wire to an aluminum part. We have been told that there is a simple method for tinning the aluminum to make this soldering easier. Can you give us any details?

N. T. F.

Answer: The following solution can be used to deposit a film of tin on aluminum alloys by simple immersion (no electric current).

Potassium Stannate	6 oz./gal.
Trisodium Phosphate	4 "
Sodium Hydroxide	1 "
	Maximum

Temperature 160°F.
Time about 5 minutes.
An amount of hydroxide higher than the above amount may cause dark deposits and blistering, and should be neutralized by acetic acid. To maintain the bath add stannate. Either sodium or potassium stannate may be used, but the potassium bath sludges less. A nitric acid dip prior to tinning is recommended. When properly performed, bright deposits about .0002" may be obtained.

Adhesion Testing

Question: We would appreciate it very much if you would tell us where we could obtain data on testing the adhesion of copper-nickel-chrome plating on zinc die-castings. We have tried several methods but have not been able to arrive at a satisfactory minimum requirement for a standard.

B. J. L.

Answer: Unfortunately there is no satisfactory method for routine testing of decorative deposits for adhesion. The tests which have been somewhat standardized usually involve the preparation of special samples and the deposition of coatings that are much heavier than the usual commercial deposits. The exact relation between the results obtained on such special samples and what can be expected of regular commercial deposits has not been fully established. For most commercial work, various shops have used the bend test as a working check for adhesion. When performed in controlled manner, this test will differentiate between good adhesion and poor adhesion, but will not evaluate degrees of adhesion in between these two extremes. At present one of the Research Projects of the American Electroplaters Society has this whole subject of adhesion and adhesion testing under investigation, but to date has not been able to devise a suitable routine test. However, their findings have been reported in Research Reports 1, 2, and 8, copies of which are available by writing to the Society. A small charge is made for these reports.

Hamilton Gold Plating

Question: We have a lot of difficulty maintaining the correct color of our Hamilton gold solution, and we are wondering if using Hamilton gold anodes would be beter than using 24 kt. anodes for this work? Some of our customers complain that our color does not match their Hamilton gold obtained elsewhere. Can you advise us on this?

M. D. F.

Answer: To the best of our knowledge there is no such thing as a Hamilton gold anode. Commercial platers use either 24 kt. anodes or stainless steel anodes. There are about as many shades of so-called Hamilton gold as there are gold platers, and we have personally seen gold plating ranging from pale yellow to deep red all called Hamilton gold. Your best approach to this problem is to request a color sample from your customer when starting on a job. We recommend that you read the recent article by *Bleiweis* in the January issue of METAL FINISHING for a discussion of the best practical methods for controlling the color of gold plating baths.

Interrupted Plating Operations

Question: In silverplating pewter and other base metals, we are not always able to plate immediately after electrocleaning. How can these articles be left so that they can be plated at our convenience without an additional cleaning?

K. R.

Answer: It is never advisable to delay plating once the cleaning operations have been completed. However, for short periods not exceeding ½ hour the parts can be left immersed in a mild (2 oz./gal.) solution of sodium cyanide after they have been cleaned and rinsed. If you are then going to a cyanide bath, no rinsing is necessary, but should the next operation after storage be an acid bath then you will have to rinse, dip in weak acid, rinse again, then proceed with the plating.

Pitted Lining in Chrome Tank

Question: Recently we set up a brand new chrome solution with new antimonial-lead steam coil and lining. About three weeks after making up the bath I noticed a yellow sludge in the botom of the tank, together with deep pitting of the tank lining. The strange thing about the pitting is that it extends only to within 6 inches of the top of the solution and no higher. The coil was also attacked, but to a lesser degree. I believe the tank is well insulated, including the steam coil inlet and outlet. The chrome tank is run from the same generator as my nickel tank. Can you give me any idea what may have caused this trouble.

E. D.

Answer: About the only possible cause for this type of trouble is current leakage, and we suggest that you look at the insulators under the anode rods to be sure there is not an accumulation of chemicals that could cause a conducting bath from the anodes to the tank. Why the pitting should stop 6" below the solution level is difficult to explain, unless the solution was first made up to the lower level, then later diluted to its final level. Perhaps other readers may have an adequate explanation for this unusual behavior of your tank lining.

Platinized Black in Gold

Question: Can you give us any information on the use of platinum chloride for producing an antique or semi-dark finish on yellow gold?

W. A. A.

Answer: Oxidizing or coloring gold with solutions of platinum salts is a simple brush-on treatment using a platinum chloride solution made up as follows:

A small amount (amount varies according to the users coloring technique) of platinum metal is dissolved in aqua regia and the resulting solution evaporated to drynes. The residue is then dissolved in either alcohol or water, according to the users preference. This mixture is brushed on the parts or the parts immersed in the solution for a time sufficient to promote the required color. Stronger solutions give more rapid and darker coloring.

Recovering Cadmium from Stripping Solution

Question: We use the ammonium nitrate strip for taking the cadmium from our plating racks. Is there any way that this cadmium can be recovered in a form suitable for further use in our plating operations?

C. S.

Answer: It is doubtful if the recovery of the cadmium would prove economical, but the following method can be used to obtain the recovered cadmium in the form of its dry hydroxide, which can be added to the regular plating solution in small amounts to replenish the cadmium content. This is not recommended, however.

The solution is first made strongly alkaline and heated to drive off the fumes of ammonia. The cadmium precipitates as cadmium hydroxide, which can be filtered off, washed free of soluble salts, and dried in an oven. Any iron in the cadmium strip will appear with the final product, but dissolved copper will be removed in the washings.

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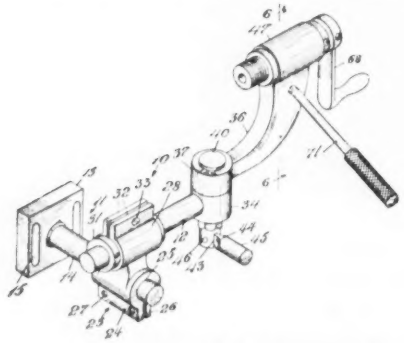
PATENTS

Universal Polishing Attachment

U. S. Patent 2,487,996. *W. D. Wellwood and W. S. Slade.*

A work holding atachment for a polishing head comprising a plate for attaching to a polishing head and the like, a post extending from said plate, a bearing member carried by said post and adjustable axially and rotatively



thereon, a shaft rockably mounted in said bearing member, an arm carried by said shaft, a work holder rotatably mounted on said arm, manual operative means for rocking said shaft and arm carried thereby for presenting the work to the polishing wheel and means for rotating the work holder.

Apparatus and Process Useful in Making Copper Oxide Rectifiers

U. S. Patent 2,488,445. *W. H. Sutton, assignor to Westinghouse Electric Corp.*

The method of manufacturing copper oxide rectifier plates which are about 12" long by 4⅜" wide by 50 mils thick which comprises the step of cooling them from the annealing temperature to about room temperature by moving them with their longer axis vertical downward into a quenching liquid at a rate of about two to three feet per minute.

Plating Rack

U. S. Patent 2,488,582. *L. Cinamon.*

A rack comprising in combination: a rod; sleeve sections mounted on said rod, at least one end of a sleeve section being provided with a sloted enlargement forming prongs and adapted to receive the end of the adjacent sleeve section and article supporting arms received in the slots clamped between said sleeve sections; and means for holding said rod, sleeve sections, and article supporting arms in rigid clamping relationship.

Polishing Material

U. S. Patent 2,489,307. *J. P. Miller, assignor to National Lead Co.*

The process of preparing a finely divided zirconium oxide polishing agent which consists in calcining oxidized zirconium cyanonitride at about 1300° C., dry milling the calcined product to less than 44 microns size, mixing the resulting product with caustic alkali predetermined in amount to yield about 1% of alkali oxide in the mixture, recalcining said mixture at about 1050° C., wet grinding the resulting product and classifying to a size desired for polishing purposes.

Electrodeposition of Tin or Lead-Tin Alloys

U. S. Patent 2,489,523. *F. L. Clifton, assigner to General Motors Corp.*

The process of producing an electrolytic bath for deposition of tin consisting essentially in providing an aqueous solution of sulfamic acid, electrolyzing said solution with an anode of tin and forming thereby in said solution a compound of tin with sulfamic acid.

Electrodeposition of Copper

U. S. Patent 2,489,538. *W. M. Phillips and F. L. Clifton, assignors to General Motors Corp.*

A bath for electrodepositing copper comprising an aqueous acid copper solution comprising essentially copper sulfate and sulfuric acid and having dissolved therein a compound selected from the group consisting of cyanamide and dicyandiamide, said compound having a concentration in said solution of about 0.1 gram per liter.

Belt Polishing and Grinding Machine

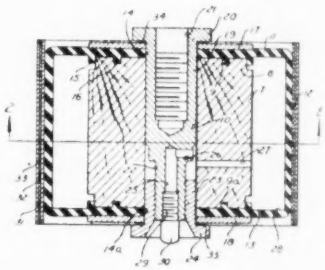
U. S. Patent 2,489,811. *H. G. Perkins, assignor to Hammond Machinery Builders.*

A belt grinding and polishing machine comprising, a base, a support arm on said base arranged for tilting adjustment longitudinally of the arm about a generally horizontal axis and laterally of the arm about a movable axis transverse to the arm, a support member secured to the end of said support arm, a motor mounted for tilting motion longitudinally with said support arm, a driving pulley rotatably mounted on said support member and arranged to be driven by said motor, an idler pulley rotatably mounted on said support member, a third pulley linearly adjustably mounted on said support member, means urging said third pulley away from a line between said other pulleys, an abrasive belt rotatably mounted on said pulleys to rotate in a plane parallel to said second axis, a lever arm pivoted on said support member, an idle shaft carried by said lever arm, a backing wheel mounted on said idle shaft and located between said driving and idler pulleys, and spring means carried by said backing member for urging said support wheel against the inside of said belt.

Inflated Polishing Wheel

U. S. Patent 2,490,472. *A. R. Raske.*

A Buffing and polishing wheel of the class described, comprising: a rigid core having a bore formed centrally therethrough and provided at its opposite ends, at the periphery, with a

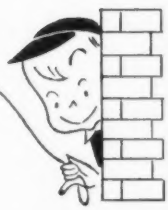


cut away portion and having, inwardly from the periphery on opposite ends, a circular groove; a supporting bag of air-impervious, flexible material mounted on said core and having, on opposite end walls, a central opening registering with the bore in said core; a circular inwardly projecting rib on each of the end walls of said bag engaging the cut away portion of said core; a circular, inwardly projecting rib on each of said end walls engaging in the groove formed in end faces of said core; inter-engaging members projected into said bore from opposite sides thereof and adapted upon inter-engaging for clamping the end walls of said bag against the end faces of said core, the core having a passage formed therein communicating with an air inlet passage formed in one of said engaging members for delivering air into the interior of said bag for inflating said bag.

NO FOOLIN'

GREEN RECTIFIERS

solve a lot of platers' problems without foolin' around a lot whether it's April . . . or some other time.



So. . . . even on April 1 you can stop foolin' long enough to get the dope on Green for your shop. Then you can fool the competition when it comes to pricing jobs, meeting deliveries . . . and a lot of other fool things that can just drive you nuts if you don't have Green Rectifiers.

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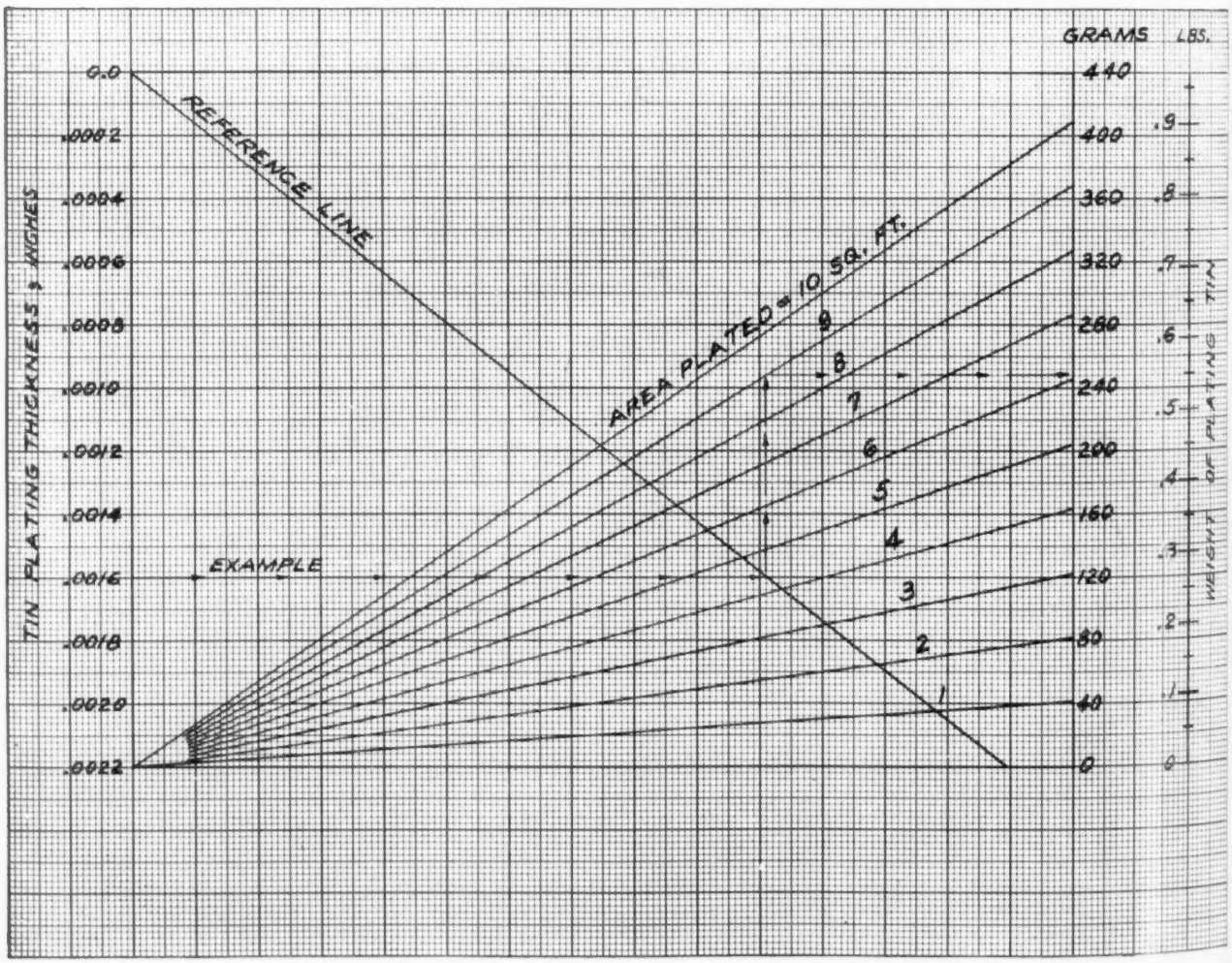
Calculating Metal Cost in Tin Plating

With the aid of the chart below it is a simple matter to calculate the metal cost of depositing a given thickness of tin on a known surface area. The example shown by the dotted line illustrates the method for calculating the total weight of tin used in plating .0016" of tin on a surface area of 9 square feet. The total weight of tin is then multiplied by the present price for tin anodes to get the total cost. For areas larger than 10 square feet, simply multiply by the proper factor.



New Methods, Materials and Equipment for the Metal Finishing Industries

Recent Developments

Antique Gold Finishes in a Single Operation

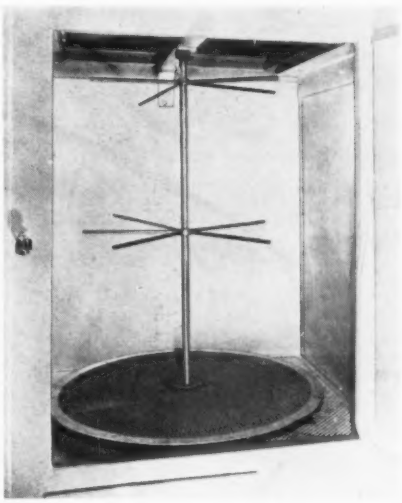
Davis-K-Products Co., Dept. MF, 54 W. 22nd St., New York 10, N. Y.

This firm announces the development of "one operation" antique gold plating solutions, which are said to make possible the production of many beautiful antique effects from a single bath, without having to resort to old-fashioned procedures that entailed many steps and usually resulted in non-uniform finishes. It is no longer necessary to smut the work, relieve, then gold plate. The new procedure involves a 10-15 second plate in the new bath, followed by a few minutes of ball burnishing. In addition to saving the wiring and un-wiring operations formerly required, this new development is claimed to eliminate much of the skill usually required by the operator in the older methods of antiquing, and makes possible the production of uniform finishes by relatively unskilled platers. The firm offers to finish samples sent to them at the above address. No charge will be made for this introductory offer.

Small-Article Metal Surface Dryer

Technic, Inc., Dept. MF, 39 Snow St., Providence, R. I.

The Technidrier is a practical dryer which transforms highly polished metal surfaces from cold water rinse to sparkling dry in less than two minutes. The important point is that the surfaces when dry are scratch and stain free, according to the firm. Labor and time saving features include elimination of rejects due to staining, elimination of alcohol and hot water rinses, ease of putting work in and taking work out, complete visibility of work in process through glass door and simple installation and operation.



The Technidrier is equipped with adjustable spindles mounted on a turntable, so that work can be removed or put in without disturbing other work in the process of drying. There are ten 14" spindles with a clearance of 14" and are adjustable to handle work up to 28" on 5 spindles, the combination accommodating either ten 14" x 14" racks or five 14" x 28" racks. The dryer operates on a 1 to 2 lbs. steam pressure and can accommodate bulk work. The Technidrier cabinet comes in blue-gray wrinkle, trimmed with stainless steel.

While originally designed for the jewelry trade, Technidrier can successfully be used in the drying of any highly finished small article or part, it is claimed.

Cadmium Brightener

The R. O. Hull & Company, Inc., Dept. X3, 1279 West 3rd St., Cleveland 13, O.

A seven page bulletin describing Rohco 20XL cadmium brightener electroplating process is available by writing to the above address.

According to the manufacturer, Rohco 20XL Cadmium Brightener gives unusual uniformity of deposit thickness; exceptional brilliance of deposit over the widest bright current density plating range; maximum production from barrel units; easy control through unusually wide latitude of operable concentration range; economical usage as the cost is many times less than the cadmium and labor saved through improved throwing power, higher production and reduced rejects.

New Chemical-Resistant Fabric

Standard Safety Equipment Co., Dept. MF, 232 W. Ontario St., Chicago 10, Ill.

Gra-Lite fabric, developed by the above firm, is said to combine the features of protection, comfort and durability demanded of a safety material. This new fabric provides resistance to a wide range of chemical hazards, including, with special preparation of the compound, resistance to anhydrous hydrogen fluoride. With Gra-Lite compound it is claimed possible to completely seal over garment seams and

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prevent chemical seepage. For maximum worker comfort, Gra-Lite is more than 40% lighter than the ordinary impervious fabric and extremely flexible, even under freezing temperatures this fabric retains its flexibility.

Gra-Lite compound thoroughly penetrates the fibres of the base fabric, which makes it abrasion resistant. It withstands harsh cleaning agents, and will not mildew or rot, according to the firm. Complete impregnation also provides chemical resisance on the inner surface of the material.

New Bath for Blackening Stainless Steel, Cast Iron and Steels

The A. F. Holden Co., Dept. MF, New Haven 8, Conn.

The above firm announces the manufacture of a new low-cost blackening process.

The weight of chemicals per gallon of water solution is 3 pounds, versus 7 to 10 pounds of the conventional water solution blacking salt.

The process, as developed, is designed for blacking stainless steels, cast iron, malleable iron, as well as SAE or any steels.

The process may be used in equipment already installed and the only variance in the process is the use of a new chemical cleaner which prepares the metal surface to obtain a uniform black.

Chemical-Resistant Cement

The Electro Chemical Supply & Engineering Co., Dept. MF, 750 Broad St., Emmaus, Pa.

This firm announces an entirely new and different type of thermo-setting resin used as an acid and alkali-proof cement or coating, called Duron.

Duron is claimed to adhere without the use of a Primer to concrete or metal, and is self-hardening at room temperature. The novel adhesive properties of Duron are said to be due to the fact that, unlike thermo-setting cements and coatings heretofore produced, Duron is not derived from phenolic or furfuryl alcohol resins.

Duron is used in the manufacture of acid and alkali-proof cements for joining brick and tile, as a coating for concrete, steel, or wood, and as an impregnant for wood. Useful materials may be produced by mixtures with metal powders, asbestos, cork and other insulating materials.

Duron is inert to solvents, fats,, oils, greases, alkalis of all concentrations, and to a wide range of acids, it is claimed.

Water Hardness Testing

Hall Laboratories, Dept. MF, Pittsburg 19, Pa.

Total water hardness, and the hardness caused by calcium alone, now are accurately measured by simple, easy methods in approximately one minute.

The above firm, in announcing the new total-hardness methods, reported that they are based on the discoveries of *Dr. Gerold Schwarzenbach*, with Hall modifications that make them convenient for general field use.

The new Hagan Total Hardness Test, as it is designated, is immeasurably superior to the time-honored but time-consuming old "soap shaking" method in general use for the past century. It involves a simple, direct titration with a distinct color change at the end point, so that the possibility of error due to subjective judgment is eliminated. Also of practical advantage in its application is the fact that interferences, although seldom found, are easily eliminated.

The new Hagan Calcium Test is, similarly, a direct titration to a clear-cut color change. No complicated heating, waiting, filtering or estimating is required. The answer, correct to less than 1 ppm of calcium, is found in one minute. Where it is desirable to determine hardness due specifically to magnesium in the water, the operator makes the total hardness test and the calcium test, the difference giving him the magnesium value.

All equipment and reagents required for either the Hagan Total Hardness Test or the Hagan Calcium Test is being made available through Hagan Corporation (parent of Hall Laboratories, Inc.) and its associated firms, Calgon, Inc., and The Buromin Company, the announcement adds.

Glass Immersion Heaters

Thermolettor Products, Dept. MF, 11 St. Andrew's Pl., Brooklyn 16, N. Y.

This firm announces a line of glass-encased immersion heaters for use in corrosive solutions where conventional metal sheaths are not usable. The glass sheaths are made of Pyrex, Vicor, or quartz, all of which are resistant to thermal shock. A new method of

For Any Plating Solution
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100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

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Here's how Industrial filters keep down the cost of plating jobs—The flow rates of Industrial filters are based on the actual plating solutions involved. You know the capacity you get. In the filtration of plating solutions there is more than just the filter. With Industrial you get an adequate filter with slurry tank, motor driven pump, valves and fittings in a complete package with one, undivided, experienced responsibility—with space requirements at a minimum.

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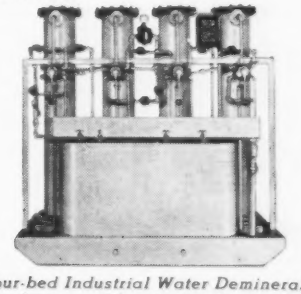

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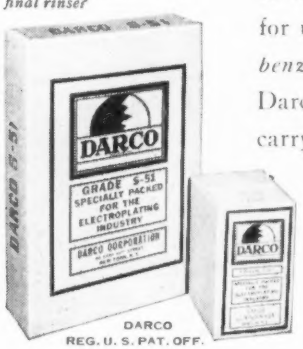
It's the rule of the sea - - and the plating industry!

Don't risk the time, labor, and expense that go into cleaning work for plating by putting clean work into a plating bath of questionable purity!

Start clean . . . *stay* clean—use Darco S-51 to trap trouble-making impurities! Darco adsorbs impurities to its surfaces before they can be deposited on the freshly cleaned surface of your work.

Is your plating bath as clean as the water in your final rinse?



Darco S-51 is especially easy to handle . . . to wet . . . to incorporate into a slurry. It's especially treated for use in plating—*the only carbon that will meet the benzol-mercury test!* Place an order for Red Label Darco S-51 today. Practically all leading suppliers carry Darco—don't accept substitutes!

DARCO CORPORATION
60 East 42nd Street, New York 17, N. Y.

vacuumatically sealing the heating element between the two layers of glass is claimed to promote a much higher rate of heat transfer than materials now on the market.

The heaters are available in sizes from 100-2500 watts, and special sizes can be made to order. The firm has also under development a glass enclosed heating element with an integral thermostatic control. The glass-sheathed immersion heaters can also be obtained with a metallized outer coating where such use is advisable.

New Material for Tumbling Barrel

Lupomatic Industries, Dept. MF, 4510 Bullard Ave., N. Y. 66, N. Y.

The above firm has just announced a new-type material which can be used for making complete barrels, or used as a lining for tumbling barrels made of other materials.

This material is called Tumb-L-Dur, and according to the manufacturer meets every specification for an ideal lining or barrel material. It has the necessary resilience so essential to tumbling, does not warp, and can readily be sawed or drilled. A particular advantage for wet tumbling, inasmuch as this material will not warp, is that there is no need to keep the barrel under water when not in use.

This new material is said to have great abrasive-resistance. In one installation, where wood wore out in less than 4 weeks, Tumb-L-Dur has been in operation for 18 months without any signs of wear, according to the firm.

The initial cost of the material is greater than for its wooden counterpart, but when uninterrupted production as well as elimination of replacement costs are taken into consideration the resultant savings are said to be considerable.

It is presently being used for fabricating barrels, as well as liners for existing barrels, and developments are continuing for a completely molded barrel. One size of a molded barrel burnishing unit will be available presently, the firm states.

New Blast Cleaning Abrasive

American Wheelabrator & Equipment Corp., Dept. MF, Mishawaka, Ind.

This firm announces the marketing of "Black Beauty," a newly developed abrasive replacing silica sand for blast cleaning and finishing operations. It's non-metallic, silica-free, and low in cost.

An important feature is the fact that it is a sharp, fast-cutting abrasive which is said to retain its abrading qualities even when reduced to very fine material. Although it has much the same properties as sand there is no free silica to create an occupational hazard. It wears 2 to 5 times longer than sand, is less damaging to equipment, is non-corrosive and stainless, and flows freely, according to the firm.

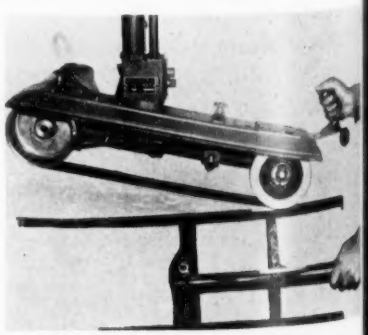
Black Beauty is supplied in a variety of sizes graded for any type of work or finish desired.

Swing Belt Grinder

Vonnegut Moulder Corp., Dept. MF, 1819 Madison Ave., Indianapolis 25, Ind.

The Vonnegut Moulder Corp. announce purchase of the patents, sales and manufacturing rights for the Newton swing belt grinder from Newton Manufacturing Company, Temple, Texas.

In its standard form the Newton machine is equipped with a push-button controlled 1½ HP, 3 phase



single phase, 3600 RPM motor driving a 2½" x 60" coated abrasive belt on a 6" diameter contact wheel. It is light and conveniently maneuverable because these primary parts are assembled in aluminum castings on a frame of thin-walled steel tubing.

When suspended directly from a ceiling or overhead beam it can be used to work over an area of 4 to 5 feet diameter, but can be swung to cover an area of 8 to 10 feet diameter when suspended from an overhead radial arm and trolley. It has a handle bar for two-hand manipulation, but also an intermediate horn type grip for convenience of one-hand operation. The frame is pivoted at the point of suspension, allowing 10" normal vertical motion of the contact wheel. It also is pivoted to allow both right and left hand angular positioning of the contact wheel. Details of design include dependable belt tracking control and a telescopic frame construction with concealed spring for automatically maintaining correct abrasive belt tension.

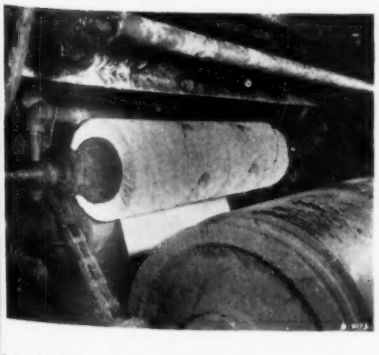
A variety of contact wheels are offered by the manufacturer of this machine and all manufacturers of coated abrasives are prepared to supply—and also to assist in specifying—the correct belt for each condition.

Power Brushing Strip Steel

Osborn Mfg. Co., Dept. MF, 5401 Hamilton Ave., Cleveland 14, O.

Power brushing, used in the continuous cleaning of strip steel at speeds of over 1500 feet per minute, is resulting in large production savings for a large midwestern rolling mill, it is claimed by the above firm. Removing all traces of rolling oil prior to electrolytic tin plating by brushing is said to prevent porous coatings and thus assures a high quality product.

The brushes used in this work are produced in units in length from four to 30 inches; and in diameter from eight-inch to 12-inch, with larger diameters available. As the steel strip emerges from the squeezer rollers it passes through the first of three brushing stations. Two Heli-Master sections are mounted on each shaft providing a 42-inch brush face. Due to the uniform dense fill assured by the special construction, these brushes insure against streaking or gaps, according to the firm.



The brushes, operating in conjunction with high pressure hot sprays and chemical cleaning baths, rotate at 1200 revolutions per minute. After scrubbing, the sheet is coiled and proceeds to the electrolytic tin plating operation.

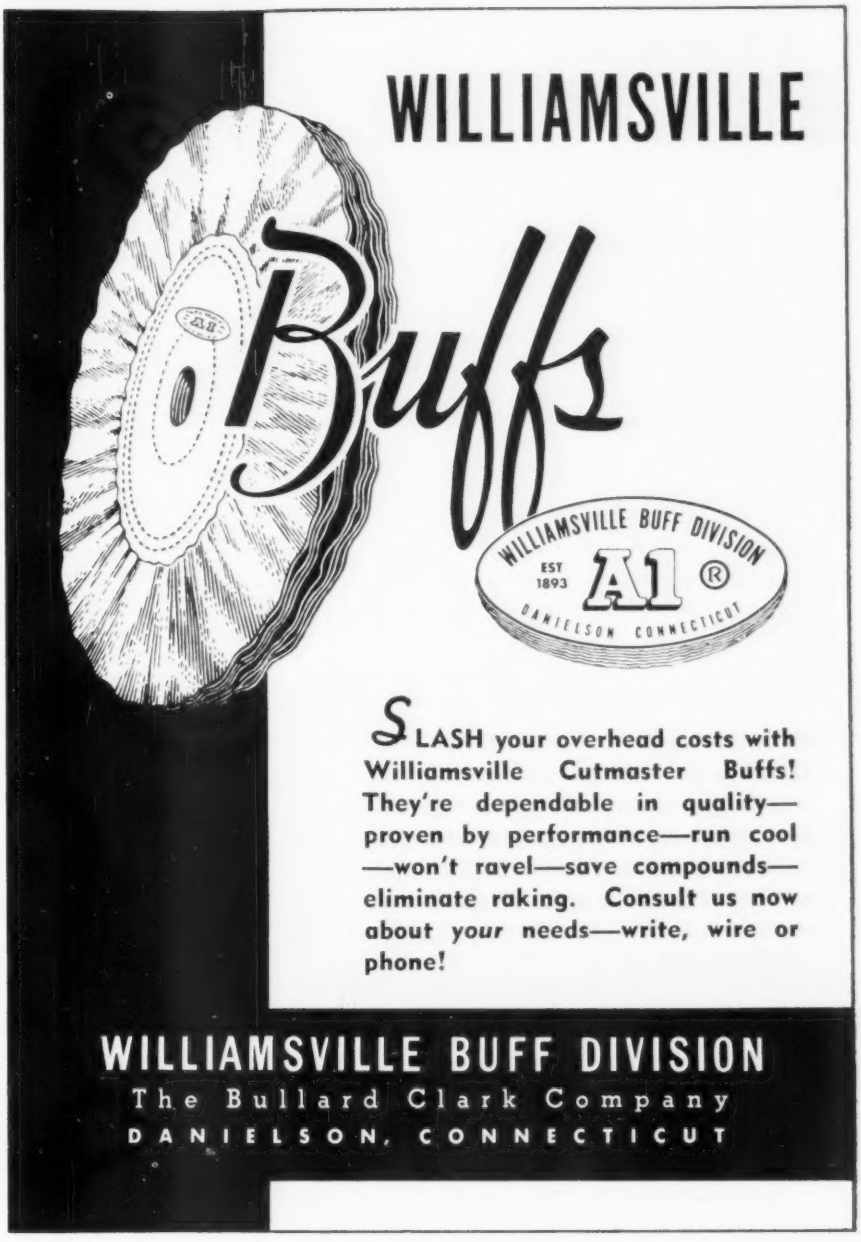
Osborn Heli-Masters are adaptable to round, square or hexagonal shafts, and are available with fills of Tampico, bassine fibre or special fibre mixtures. They are also made of stainless and carbon steel wires, nickel silver, silicon bronze or monel metal, or with synthetic materials such as nylon or pliofilm.

New Polisher for Crankshaft Journals

Tillis Manufacturing Co., 123 Marine Ave., Elkhart, Indiana.

The addition of a medium-priced crank-shaft polisher to their present line of automotive machine shop tools is announced by the above firm.

The new unit, constructed from aluminum alloys of high tensile strength, is portable, having an approximate weight of 26 pounds. It can be operated manually and can be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SLASH your overhead costs with Williamsville Cutmaster Buffs! They're dependable in quality—proven by performance—run cool—won't ravel—save compounds—eliminate raking. Consult us now about your needs—write, wire or phone!
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TROUBLE-FREE WAY

to produce

MIRROR-LIKE FINISHES ON NICKEL

Whether you require a nickel finish with superior cutting qualities —or a 100% saponifiable composition for coloring prior to chrome plating, we have a SPEEDIE Bright Gloss Composition for you —for instance:

- No. 86-D — an old standby — can't be beat for buffing and coloring on nickel. Medium greasy, sticks to the wheel.
- No. 2119 is 100% saponifiable —does an outstanding job of coloring nickel. Highly recommended for work which is to be chrome plated.
- No. 1931 was especially developed for cutting on heavy work such as bumpers. Used with outstanding success on difficult buffing operations.

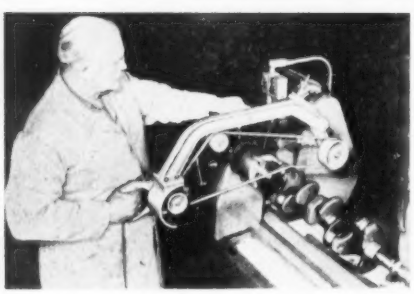
Learn about the complete line of *top quality* SPEEDIE Buffing and Polishing Compositions. Whatever your problem, there's a job-proved *SPEEDIE* product to help you — Tripoli, Stainless Steel, Satin Finish, Emery Cake, Grease Stick, etc.

Polishing Room Supplies and Equipment

BP THE BUCKEYE PRODUCTS CO.

7033 Vine Street Cincinnati 16, Ohio

Cable address: Buckprod



adapted to overhead suspension, using counter weight balance. The machine can be operated with either wet or dry abrasive belts.

The bearings throughout the machine, including the motor bearings are sealed against coolant liquid and abrasive penetration. Powered by a ½ horse power motor, it provides a smooth finish to bearing surfaces to such exacting tolerances that motor break-in time is practically eliminated.

The unit is not limited to small automotive crank-shafts and uses any belt width up to two inches. To relieve sudden strains when polishing journals off-center, the machine is provided with an automatic coilspring belt adjuster.

Economical Masking of Threads and Holes

Duggan Masking Devices, Dept. MF, 2030 W. Fort St., Detroit 16, Mich.

This firm is now marketing molded neoprene "Caplugs", which can be used for plugging holes and masking threads on bolts and studs to prevent them from being plated. Available in five sizes, these Caplugs are easily applied and removed, due to their molded angular hole and large-diameter base. These plugs are resistant to attack by all plating baths, and are non-absorbent, thus preventing contamination of processing solutions. The firm offers a free sample kit containing one each of the five sizes to all those writing on company letterhead to the above address.

Illuminator for Pocket Microscope

Buhl Optical Company, Dept. MF, 1009 Beach Avenue, Pittsburgh 12, Pa.

This firm has announced a special illuminator for use with its S-129 Pocket Microscope. The microscope, having selective magnification ranging from 40 to 60 power, is widely used in industry for inspecting raw materials as well as cast, machined, and finished surfaces of all kinds.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch Holds Annual Banquet

On Saturday February 25th the New York Branch held its annual Educational Session and Banquet at the Hotel New Yorker, and featured an outstanding technical session in the afternoon, followed by their usual highly enjoyable banquet and entertainment in the evening. Anyone who has the job of topping the fine work by Chairman *George Herrmann* and his hard-working committee in future years has really got a man-sized job, for all those attending this year's affair were unanimous in acclaiming it the finest the Branch has ever held.

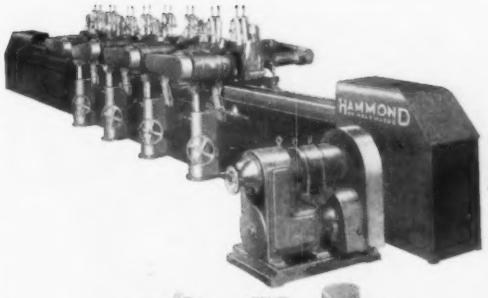
The afternoon educational session was presided over by *Derick Hartshorn*, who introduced the speakers and led the discussion periods. The first speaker was *Mr. William Phillips*, ably assisted by genial *Frank Clifton*, both of General Motors Research. Their illustrated show of plating processes, projected on the screen so that all could see the actual progress of the reactions, is the most interesting one we have seen at any of these meetings

and the most effective means available to show the fundamentals of anode solution, polarization, wetting agents, addition agents, and electrolytic cleaning.

The second speaker, *Mr. Frank La Que*, of International Nickel Co., talked about the galvanic corrosion of plated deposits. The highlights of his remarks included data to the effect that cadmium coatings offered more protection to aluminum alloys than zinc coatings did, and that equal thicknesses of composite coatings of copper and nickel seem to provide better resistance to corrosion on zinc-base alloys than they do on steel.

Leonard Chesworth, of United-Carr Fastener Corp. closed the technical session with some important remarks on barrel plating operations. He stated that small additions of nickel sulfate, about .12 oz/gal., to barrel cadmium solutions aids in maintaining uniform brightness of the deposits. The cadmium bath contained 3 oz/gal. of metal and 16 oz/gal. of total cyanide. In plating bright barrel nickel, continuous electrolytic purification was found beneficial in the production of bright and ductile deposits. He also discussed his experience with heavy, bright zinc plating, wherein he deposits about 60% of the total thickness from a dull zinc bath, followed by the remainder from the bright solution.

The technical sessions were attended by about 200 persons, and the evening activities by approximately 1200 members and guests, all of whom thoroughly enjoyed the entertainment and dancing until the wee hours of the 26th.



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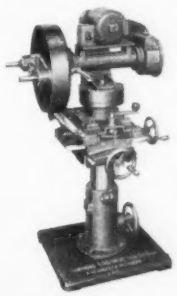

There are ten new Junior Automatics in the Hammond Line, to be used with polishing or buffing wheels or with abrasive belts. Model E2PF shown.

Users of Hammond Automatics report 2000 pieces or more per hour, more uniform, better finishing, less operator fatigue and specially, *lower costs.*

SEND SAMPLES: Send us one finished and several rough samples. You will receive a complete Engineering Report and Production Analysis without obligation.

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Good Machinery Since '82

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Chicago Branch

At the February meeting 40 members and guests were present for dinner, with a total attendance of 110 at the regular meeting. The speaker, *Mr. R. Scott Modjeska*, discussed a possible alloy substitute for cadmium which possesses good corrosion resistance, good solderability, and has a pleasing satin-white appearance. The alloy is 78% tin, 22% zinc, with a suggested solution formula as follows:

Sodium Stannate	9.0	oz/gl
Zinc Cyanide	.54	oz/gl
Sodium Cyanide	3.5-4.0	oz/gl
Sodium Hydroxide	.5- .6	oz/gl

Cast 80/20% Anodes are suggested and the operating temperature is 160° F.

Cathode efficiency at 30 amp/ft²—approximately 90%. The suggested operating range is 30 to 40 amp/ft². The possibility of using potassium salts in place of the sodium salts was also discussed, with the thought that there would possibly be less sludging with the potassium salts. Materials are readily available and at this time there does not appear to be an imminent shortage in tin or zinc.

Mr. Modjeska made a comparison between the galvanic series and electromotive series, pointing out the difference and wherein errors in interpretation are made. The usual question period followed the talk.

Indianapolis Branch Annual Educational Session

Elaborate preparations are under way for the Seventh Annual Educational Session and Dinner-Dance, presented by the Indianapolis Branch of the American Electroplaters' Society, to be held Saturday May 6, 1950 at the Indianapolis Athletic Club.

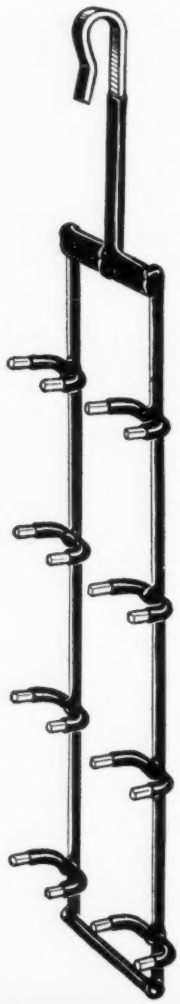
The Educational Session will include papers on Rectifiers vs. Motor Generators, High Chloride Nickel Baths, and others. Entertainment and dancing will follow an evening dinner

The program is open to anyone interested in the art, science, and production of electroplating. For tickets or reservations contact *Mr. Robert Bruck, 849 Massachusetts Ave., Indianapolis.*

Toronto Branch Annual Educational Session

The Annual Educational Session of

When It Comes to Rack Insulation



You should consider BUNATOL No. 1002 Paste insulation. This 100% solids rack coating is so easy to use and requires so little time, yet lasts so long on the rack. The new high gloss surface provides complete rinsing and extra toughness. The baked-on Primer gives tremendous adhesion of the thick Paste coating to the rack, and eliminates seepage. A rack running in your tanks is the best proof of the superiority of No. 1002. Write for details of our plan to insulate one of your racks for this test without cost.

NELSON J. QUINN COMPANY TOLEDO 7, OHIO

— for 15 years —

Rack Insulation Exclusively

the Toronto Branch of the A.E.S. will be held on May 6th at the General Brock Hotel, Niagara Falls, Ont. At the afternoon technical session the following speakers will be heard:

Mr. Edwin Rinker, Bart-Messing Corp., Brooklyn, N. Y.—"Cleaners."

Mr. Harold Faint, Industrial Filter & Pump Co., Chicago—"Filtration."

Mr. Wm. Phillips, General Motors, Detroit—"Plating Zinc Die-Castings."

The evening session will feature a dinner and dancing until the wee hours.

New England Regional Meeting

The 11th Annual New England Regional Meeting of the A.E.S. will be held at the Hartford Club, Hartford, Conn., on Saturday, May 6th, 1950. This meeting, the high spot of the season for New England electroplaters and metal finishers, is sponsored jointly by the various branches throughout the area, and will as usual present an outstanding technical session and social gathering.

The technical session is slated to start at 1:45 p.m., and will feature the following experts:

Mr. Kenneth Huston — Subject: "Corrosion."

Mr. Cleve Nixon—Subject: "Plating Die-Castings."

Mr. Howard Boyer—Subject: "The Metal Under The Plate."

The banquet and entertainment is scheduled to start at 7 p.m. Chairman for the affair is *Mr. F. W. Smith*, and *Mr. A. J. Dankevitch* is co-chairman. A special program has been arranged to entertain the ladies attending.

Milwaukee Branch

Annual Educational Session

The Annual Educational Session and Banquet of the Milwaukee Branch of the American Electroplaters Society will be held at the Schroeder Hotel on Saturday April 29th, 1950.

A Symposium on Bright Finishes will be presented at the afternoon Educational Session at 2:00 P.M. as listed below.

1. Notes on Buffing and Polishing—*C. F. Nixon*, Ternstedt Division of General Motors, Detroit, Mich.
2. Low Cost Finishing with Roto-Finish—*C. H. Castle*, Roto Finish Company, Kalamazoo, Mich.
3. "A Buffing Nickel"—*Dr. R. M. Beckwith*, Harshaw Chemical Company, Cleveland, Ohio.

This program will be of great interest to platers, in view of need for lower finishing costs.

A Banquet and Dance is planned for the evening, and a floor show will be presented to round out the entertainment. All members and others who may be interested in plating are cordially invited to attend.

Twin City Branch

The Twin City Branch of the A.E.S. met on Monday, February 6, 1950, in the Lodge room of the Covered Wagon. There were thirty persons present.

Following dinner, Branch President *Clifford A. Bowman*, of Minneapolis Honeywell Regulator Co., introduced the following guests; *Jack Tobin*, of Standard Varnish Co., Minneapolis; *Chuck Kuplian*, *Cliff Nelson* and *Ken Tonjum*, of Jostess, Inc., Owatonna, Minn.; *Arthur Coapman*, of Udylite Corp., Detroit, Mich.; *Robert G. Peterson* and *Robert H. Peterson*, of Twin City Chromium Plating Co., of Minneapolis.

The following new members were introduced and recommended to the branch: *Terry Thomson* and *Henry Makino*, both of Minneapolis Honeywell Regulator Co. *Mr. L. N. Gushard* of Cedar Falls, Iowa, was accepted to membership but was unable to attend the meeting.

Following the business meeting, Branch Librarian *Gunnar Deedon*, of Turco Products, Inc., introduced *Mr. Howard J. McAlder*, President of Formax Mfg. Co., Detroit, Mich., who

spoke to the Branch on "The Inside Story of Buffing Compositions and Wheels." Mr. McAleer presented a most interesting talk and considerable interest was aroused.

Los Angeles Branch

The March meeting of Los Angeles Branch in Rodger Young Auditorium was devoted to election of officers and discussion of plans for the branch's annual educational session.

Ed Wells was named by President *Allan Sulzinger* to serve as master-of-ceremonies during the nomination and election of officers, a chore which Ed performed with the snap and tradition made famous by *Earl Coffin*. The following were elected:

President: *Richard J. Wooley*, Pacific Coast Mgr., United Chromium, Inc., first vice president: *Roy Lostutter*, Hard Chrome Plating Co.; second vice-president: *Myron Orbaugh*, Bone Engineering Co.; secretary: *A. D. McDonald, Jr.*, Hallenscheid-McDonald Co.; treasurer: *Ernest Fest*, Tool & Jig Plating Co.; librarian: *Morton Schwartz*, Morey Plating Co.

Allan Sulzinger, Donald Bedwell and Walter Behlendorf were unanimously elected to serve as the board of managers, with retiring president Sulzinger named chairman.

Messrs. Wooley, Orbaugh and Bedwell were elected delegates to the Boston convention, with John Hunter, Peter Rogers and Morton Schwartz as alternates.

A report given by *Jack Beale* disclosed that the research committee is making commendable progress in obtaining sustaining members to support the research fund. To date, Beale reported, six sustaining members are on the chapter's books, including U. S. Spring & Bumper Co.; Kelite Products, Inc.; Turco Products; Modern Plating Co.; Liberty Plating Co., and Crown City Plating Co.

Donald Van Zile of Hollymade Hardware Co. was initiated into membership.

At the conclusion of the business session, the educational committee, headed by *A. D. "Bud" McDonald, Jr.*, presented a film from the U. S. Bureau of Mines film library, entitled "Tinplate."

ELECTRODEPOSITORS TECHNICAL SOCIETY (England)

The Electrodepositors Technical Society is celebrating the twenty-fifth anniversary of its founding by holding a three day Silver Jubilee Conference at the Grand Hotel, Eastbourne, April 20-22, 1950.

An extensive technical and social program is planned for the occasion. The following papers will be presented:

Electropolishing of Nickel in Urea-Ammonium Chloride Melts, by *T. P. Hoar*.

Commercial Electropolishing of Stainless Steel, by *P. A. Charlesworth*.

New Developments in Electropolishing, by *H. E. Zentler-Gordon*.

A Simple Instrument for Measuring the "Surface Truth" of Metal Surfaces, by *G. E. Gardam*.

Plating Copper-Cadmium Alloys from Cyanide Baths, by *E. E. Longhurst*.

Deposition of Tin-Cadmium Alloys by *P. S. Bennet*.

Plating of Speculum-Further Developments, by *P. S. Bennet*.

X-Ray Structure of Speculum Deposits, by *H. P. Rooksby*.

Causes of Discontinuities in Electrodeposits, by *U. R. Evans* & *S. C. Shome*.

Plating Tin from Stannous Fluoborate Baths, by *N. Parkinson*.

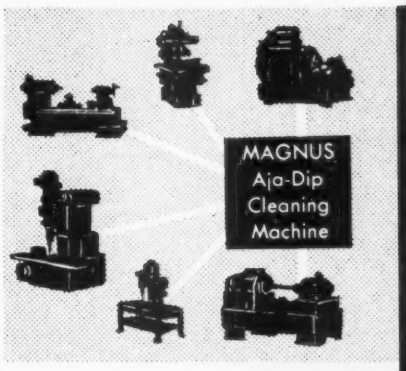
Etching Aluminum for Direct Plating, by *J. M. Bryan*.

Emulsion Cleaning, *G. Schmerling*.

Surface Active Agents in Cleaning of Metals, by *R. C. Tarring*.

Education in the Electroplating Industry, by *C. Harris*.

Interpretation of Specifications, by *Dr. S. Wernick*.



Flexible MAGNUS Aja-Dip Batch Cleaning

SAVES $100 per DAY

PRODUCTION of steel yokes for electrical relays involves the cleaning of parts between many stamping and forming operations. In one manufacturer's plant, the various forming operations were formerly carried out in widely separated areas. Adequate cleaning and production were not being obtained. A conveyor type cleaning machine was not the answer because of the time element between operations.

To remedy this situation, all stamping and forming machines were grouped in horseshoe formation in one room. All cleaning is now being done by one #4 Magnus Aja-Dip Cleaning Machine, using Magnus 92S.

Perforated metal baskets, holding about 2500 parts, catch the units as they drop out of the forming machines. As a basket is filled, it is first allowed to drain to conserve cutting oils, and is then loaded into the Magnus Aja-Dip Machine. After 3-5 minutes' agitation in the cleaning solution, parts are free of all oil and chips. Drained and self-dried, they are ready for use without rinsing, since the dried solution acts as an effective intermediate rust protection.

Under the former set-up, only 7000 yokes were produced daily. The new set-up gives them 10,000 per day. Savings of at least $100 per day over the old method are realized in reduced cleaning costs, increased production and cutting oil economies.

Your local Magnus Representative is ready to work with you to cut your cleaning costs with Magnus Chemicals and Magnus Aja-Dip Machines. Just tell us when you'd like him to call.

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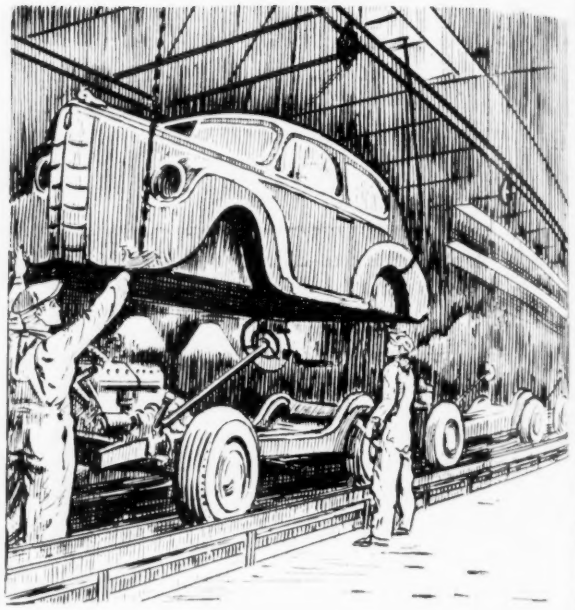
Magnus
CLEANERS • EQUIPMENT • METHODS

MOTOR CITY PLATING NEWS

by

Edward Finne



The Michigan Water Resources Commission ruled Feb. 21, 1950 that three manufacturing companies in Bronson, Mich., must find a safe means to dispose of cyanide and chromium wastes which endanger a well from which the city gets its water supply.

The commission claims that cows and fish have been killed by plating wastes being dumped into seepage ponds instead of being treated chemically to neutralize the poisons.

The companies involved are the *Douglas Mfg. Co., Bronson Plating Co.*, and *L. A. Darling Co.* All have been ordered by the Commission to quit using the seepage pond by Jan. 1, 1951.

* * *

Harry J. Bryant, recently with the Mid-West Abrasive Co., has been appointed sales representative in the Detroit area for the Michigan Abrasive Co.

* * *

The Udylite Corp. has purchased a one story building at 2485 Scotten, formerly occupied by the Scotten Mfg. Co.

The property, which contains 27,000 sq. feet of floor area and over one acre of land with New York Central railroad siding, will be used to enlarge the Scotten Avenue facilities of the Parker-Wolverine Division of the Udylite Corp.

* * *

The *Society of Automotive Engineers* held, as a part of their National Passenger Car Body and Production Meeting at the Book-Cadillac Hotel in Detroit March 14-16, a symposium Tuesday morning, March 14, concerning industrial waste disposal.

L. A. Danse, supervisor of materials and processes of General Motors, served as chairman of the meeting. The following speakers and subjects comprised the program:

D. E. Bloodgood, Purdue University—Controlling Plating Department Wastes

J. E. Cooper, Ford Motor Co.—Disposal of Acid Wastes

C. W. Hathaway, Chevrolet Motor—Removal of Soluble Oil from Waste Water

L. C. McCabe, Bureau of Mines—Smoke Abatement

* * *

The Detroit section of the *American Chemical Society* held a monthly meeting on Tuesday, Feb. 21, 1950, at the Rackham Memorial Building.

A dinner preceded the regular meeting and the speaker was Inspector *A. C. Langtry* of the Detroit Police Dept. who spoke on "Scientific Crime Detection."

The speaker of the main meeting was *Dr. Avery A. Morton*, Professor of Chemistry, Massachusetts Institute of Technology, who spoke on the subject "Organosodium Reagents as New Tools for the Chemist."

* * *

Fire destroyed practically all of the plating facilities of the *Manufacturers Plating Corp.*, 487 W. Alexandrine, Detroit on Jan. 18, 1950. The polishing and buffing department, located in an annex, was untouched. Damage to the plating department and offices was estimated at $60,000 by *Edward Kahn*, owner. The company's business is job nickel and chromium plating of steel and diecast automotive parts.

* * *

Van M. Darsey, president of Parker Rust Proof Co., Detroit, announced the election of *Clarence J. Huddleston*, executive vice-president of Wabeek Bank, as a Parker director to take the place of the late Albert Foster of Toledo. *Robert W. Englehart* was also elected executive vice-president of Parker.

* * *

John Jacks, formerly process engineer at A. C. Spark Plug Corp., Flint, Mich., has moved to the Continental Die Casting Co. of Holly, Mich., where he will function as plating foreman. Jacks is replacing *Julius Thomas* who left Continental and is now employed by Ford Motor Co. at their new die casting plant in Monroe, Mich. Thomas is in charge of plating at the new Ford plant.

* * *

Wall Wire Products of Plymouth, Mich., has recently expanded their plating department. The expansion includes new semi-automatic zinc plating equipment which will replace former hand operated tanks.

* * *

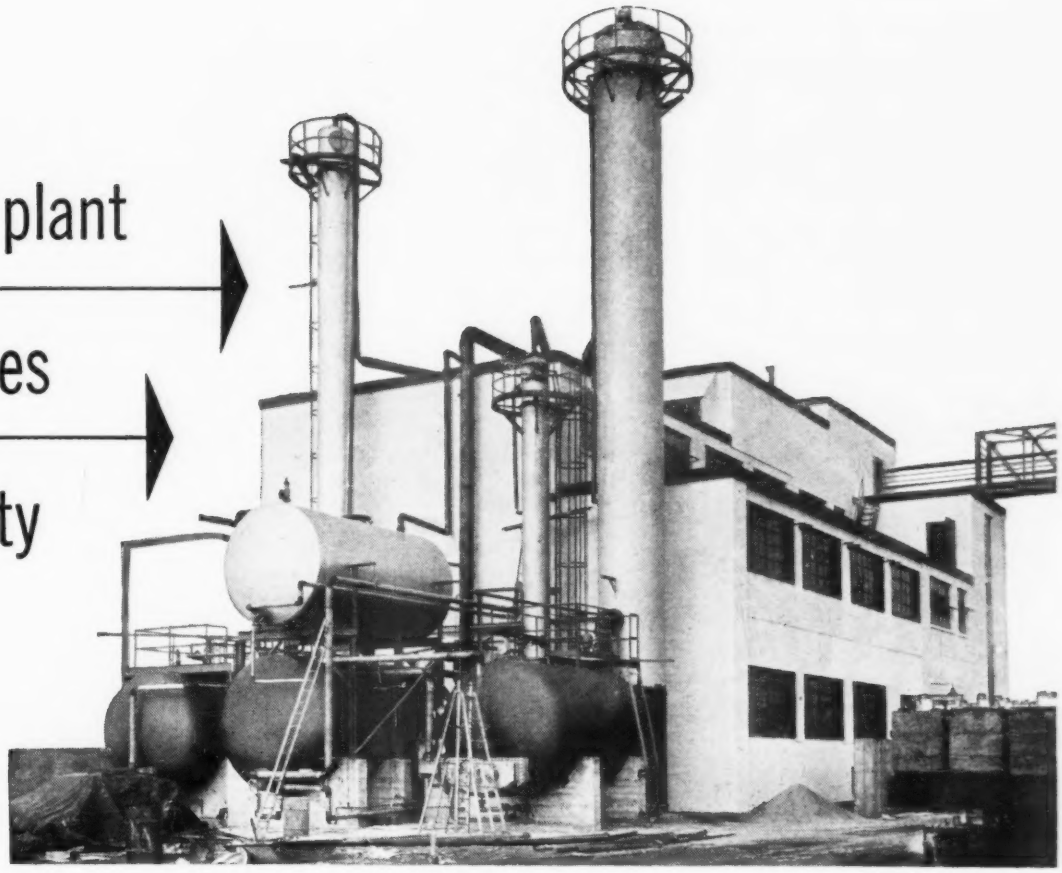
Auto City Plating Company announces the purchase of premises located at 197 S. Waterman, Detroit. Increased business necessitated moving from its present location at 3456 Denton.

The new plant, it is claimed, will be one of the largest, most modern contract plating shops in the country.

this new plant

assures

quality



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Niagara's new plant for the production of NIALK TRICHLORethylene is completely modern and makes use of special control equipment to satisfy the most exacting requirements for quality and stability.

It is designed to permit increased production facilities— to meet expanding demands.

This coupon brings you a pamphlet which answers all your questions about NIALK TRICHLORethylene. Fill in and mail today.

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

Liquid Chlorine · Caustic Potash
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NIALK TRICHLORethylene

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Gentlemen: Please send me a copy of your pamphlet on NIALK TRICHLORethylene.

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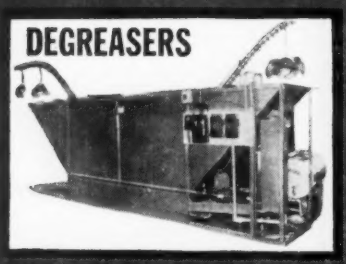
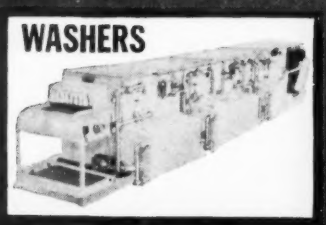
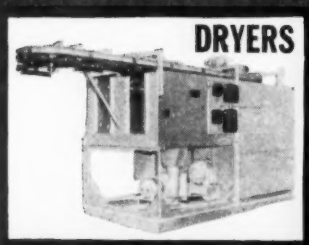
Is METAL PARTS CLEANING a bottleneck in your plant?







A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

OPTIMUS VAPOR DEGREASERS are available in all various types and stages, straight vapor, vapor-spray, liquid-vapor and combinations of these. All sizes from simple batch type degreasers to custom built monorail or cross rod conveyor models.

OPTIMUS METAL PARTS WASHERS — single or multiple stage — screw or conveyor, mesh belt or monorail types. Can be applied to a wide range of operations as well as the handling of rust preventatives and other coatings.

OPTIMUS DRYERS embody a specially designed system of directional air jets which assure spotless drying after plating or polishing and before subsequent painting, plating or lacquering.

Submit your metal parts cleaning problem to our engineering staff. SEND FOR complete catalog of OPTIMUS Equipment.

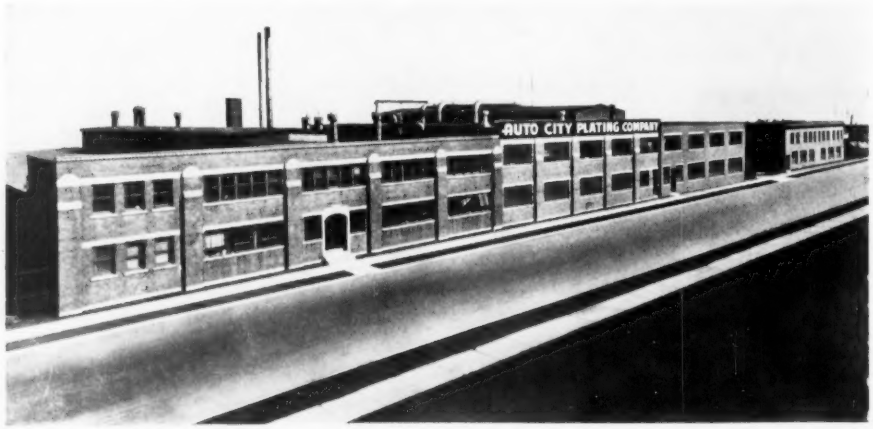
Distributors of
"Midsolv"
A Perchlorethylene Degreaser Solvent
"Triclene D"
A Trichlorethylene Degreaser Solvent

SEND FOR
COMPLETE CATALOG AND
ADDITIONAL INFORMATION.

OPTIMUS EQUIPMENT COMPANY
11 Water Street **Matawan, N. J.**
Offices in principal cities

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

There will be approximately 80,000 sq. ft. of floor space in the new set-up with another 2 acres of vacant ground for future expansion. Automatic polishing and plating equipment is now being installed. *A. F. Cassin*, general manager, estimates that the move will be completed by April 1st. Employment at the new plant should reach 350 when facilities are completely installed.



Auto City was founded in 1923 by *H. E. Adelsperger, Jr.*, its present President and Treasurer. The company specializes in specification plating of automotive parts, mainly bumper guards, grilles, mouldings and window and windshield frames.

Detroit Branch

The Detroit branch of the AES held its March meeting at the Hotel Statler on Friday, March 3, 1950 with a good attendance.

Twelve new members were elected, making a total membership of 497, which is only 3 short of the goal of 500 set by the membership committee.

B. F. Lewis, Northwest Chemical Co., chairman of the nominating committee and his committee members, *R. Axsom*, *H. M. Cherry*, *C. W. Knights*, and *W. L. Pinner* proposed the following slate for nomination for the coming fiscal year:

President—*E. A. Hahn*—Lyon, Inc.
1st V. Pres.—*F. L. Clifton*—General Motors Corp.
2nd V. Pres.—*H. E. Head*—Briggs Mfg. Co.
Sec'y-Treas.—*J. Gurski*—Ford Motor Co.
Board of Managers—*C. Borlet*—Harshaw Chemical Co.
Educational Chm.—*L. C. Borchert*—Houdaille-Hershey Corp.
Delegates—*R. L. Redmond*—Automotive Rubber Co.; *L. M. Morse*—Chrysler Corp.
Alternates — *F. L. Clifton* — General Motors Corp.; *W. L. Pinner*—Houdaille-Hershey Corp.; *R. B. Saltonstall*—Udylite Corp.

The district manager of the Bakelite Corp., *Mr. H. McGowan*, acted as chairman for the educational session of the meeting and introduced the two speakers, *W. J. Connelly*, of the Bakelite Corp., and *George Walker*, of Plastiplate, Inc.

Mr. Connelly, talked about plastics, giving a highly informative and entertaining talk augmented with a few of his sleight of hand tricks. Mr. Walker, well experienced in the plating of plastics, generally described the past practices used in plating plastics and went into considerable detail concerning the processes his company now employs to finish plastic items.

Business Items

Wilfred McKeon Weds

Wilfred S. McKeon, President of *Sulphur Products Company* of Greensburg, Pa., was married recently to *Miss Alma Hensel*.

The wedding ceremony was solemnized at the Most Holy Sacrament Rectory, Greensburg, Pa.

The former Miss Hensel is principal of Rughton School in Greensburg. Mr. & Mrs. McKeon will make their home at 913 Highland Ave., Greensburg, Pa.

Ricketts Joins C. F. L'Hommedieu Co.

Mr. Cliff L. Ricketts recently joined the organization of the *Chas. F. L'Hommedieu & Sons Co.*, of Chicago, as a technical representative. Mr. Ricketts is a graduate chemical engineer with long experience in the metal finishing field, and will be available to customers for solution of their problems.

The firm also announces that *Mr. John J. Meehan* has been appointed sales representative in the San Francisco-Oakland area, and will have his office at 1345 16th Ave., San Francisco. Mr. Meehan is secretary of the San Francisco Branch of the A.E.S.

Federal Grants for Water Pollution Studies Exhausted for This Year

Public Health Service grants to States and interstate agencies for studies of water pollution resulting from industrial wastes were terminated for the current fiscal year with the approval last week of $17,774 to Virginia, the last State to be certified for this purpose, Federal Security Administrator *Oscar R. Ewing* announced recently.

Totalling $995,427, the grants were made from a $1,000,000 fund appropriated to the Federal Security Agency in June, 1949, by Congress under authority of the Water Pollution Control Act of 1948. The Act authorizes the appropriation of $1,000,000 a year for five years "for the conduct of investigations, research, surveys, and studies related to the prevention and control of water pollution caused by industrial wastes."

The $4,573 which represents the unspent remainder of the appropriation will be carried over into the next fiscal year and will be applied to other stream pollution studies. Meanwhile, the list of State grants for the fiscal year ending June 30, 1951, has been compiled and awaits Congressional approval.

CHROMIC ACID

99.75% PURE

SODIUM BICHROMATE
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POTASSIUM BICHROMATE

MUTUAL CHEMICAL CO. OF AMERICA — MUTUAL — NEW YORK N.Y. — SINCE 1845 — REG U.S. PAT. OFF.

MUTUAL CHEMICAL COMPANY OF AMERICA

270 Madison Avenue, New York 16, N. Y.

Magnus Conducts Regional Conferences

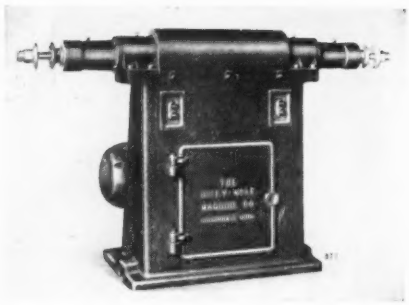
The second of a series of six Regional Technical Sales Conferences for the field service representatives of the *Magnus Chemical Co., Inc.*, was held at the Park Hotel, Plainfield, N. J., February 16th and 17th. It was attended by the Magnus representatives in the Middle Atlantic States.

The sessions during the conferences were conducted by *Dave Blanchard*, Vice President in Charge of Sales, and were devoted to papers discussing the latest developments in modern methods of cleaning in the many and varied industries serviced by the Company.

The technical discussion was highlighted by a report given by *Dr. R. W. Mitchell*, Technical Director, in which he introduced several new products developed as a result of extensive research in the Magnus Laboratory.

The group meetings were also addressed by *D. P. Blount*, Sales Manager, Chemical Division; *A. W. Bowling*, Sales Manager, Equipment Division, and *R. D. Kreie*, Advertising Manager.

A similar conference was held January 26th and 27th at Boston for the Magnus representatives in the New England States. Additional conferences are scheduled for Chicago, Cleveland, Atlanta and Tulsa this spring.



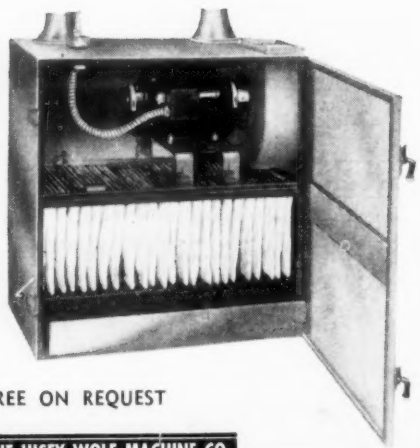
HUSKY
and
FAST!

Long trouble-free service and ease of operation are the prime requisites for equipment of any kind.

HISEY Buffers—Polishers embody these features to such extent affording lowest cost per year with maximum production.

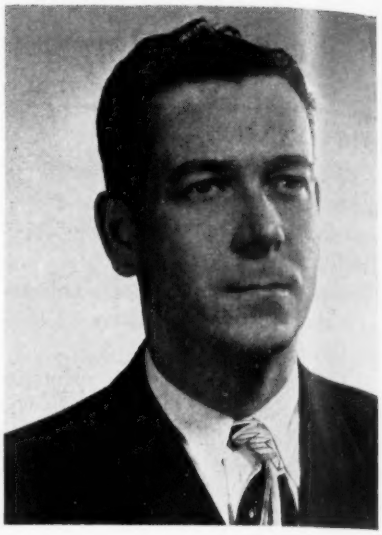
They are made from small bench types up to 30 H.P. Pedestal types. There is a size and type particularly suited to your requirements. Let us show you.

These new HISEY Dust Collectors fill a long felt need for efficient dust collecting at reasonable cost. They are made in four sizes which cover most applications and can be supplied with new machines or for machines already in service.



CATALOG 71FA FREE ON REQUEST

Hisey THE HISEY-WOLF MACHINE CO.
CINCINNATI 8, OHIO
Division of The Cincinnati Electrical Tool Co.



A. L. Pietrowicz

lubricants have been developed for their compositions. These new components are claimed to have unusually high emulsifying and saponifying characteristics which result in greatly improved cleanability. Due to certain processing methods, the abrasive material itself has been produced in extremely fine particle sizes, thereby providing extremely large number of cutting edges and a very large abrasive surface in a given volume of the material. The Prozite line is reported to be incorporating compositions for buffing non-ferrous metals including

G. S. Scott

die castings, stainless and regular steel, precious metals, plastics, and rubber.

Prozite Co. Formed—To Market New Line of Abrasives and Compositions

The *Prozite Company*, a recently formed Michigan corporation, has announced that *Gerity-Michigan Corporation*, Adrian, Michigan, has been appointed exclusive national sales agent for its new line of buffing and polishing compositions. The Prozite Company is jointly owned by Poor & Company, of Chicago, and Calumet and Hecla Consolidated Copper Company, Calumet, Michigan. *A. L. Pietrowicz*, formerly Vice President of Chicago Plating Company, has recently been appointed Sales Manager for The Prozite Co.

James Gerity, Jr., President of Gerity-Michigan, has announced that *G. S. Scott*, Vice President, will be in charge of The Prozite Division. The new products, incorporating an entirely new abrasive material to replace tripoli, include Prozite bars and liquids for buffing operations, Pro-Brite lime finishes, Pro-Lube lubricant stick for abrasive coated polishing wheels and belts, and Prozite emery cake.

Prozite products are manufactured in Calumet, Mich., where the source of the new abrasive deposits is located. Research laboratories are in Waukegan, Ill. It has been reported by Mr. Pietrowicz that, in order to make use of the new Prozite abrasive material an entirely new line of activated bases and

Alcoa Chief Metallurgist to Receive Honorary Award

Robert H. Brown, chief of chemical metallurgy at Alcoa's research laboratories in New Kensington, Pa., has been chosen by the National Associa-

tion of Corrosion Engineers to receive the Whitney Award for 1950 "in recognition of his outstanding contributions to the science of corrosion." The Whitney Award is international in scope, and is one of the highest honors in the field of corrosion engineering.

Mr. Brown holds many patents related to his field and is the author of numerous articles on corrosion.

An alumnus of Drexel Institute of Technology, Mr. Brown was graduated in 1927 as salutatorian of his class. He continued his studies at Massachusetts Institute of Technology as a research associate investigating corrosion mechanisms, and in 1930 was awarded the

Robert H. Brown

Master of Science degree in chemical engineering. Since 1931, he has been associated with Aluminum Research Laboratories where he now directs research on the chemical behavior of aluminum and magnesium alloys.

Albert C. Geller

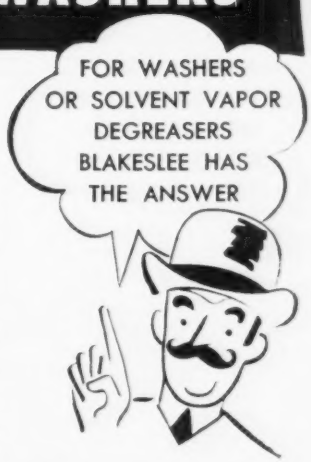
Since the days of the Tandem Bike...

BLAKESLEE
HAS PIONEERED
METAL PARTS WASHERS

In the days when handle bar mustaches, derby hats and celluloid collars were popular . . . Metal parts were already being washed in Blakeslee washers.

Blakeslee engineers are constantly improving cleaning methods and speeding up cleaning operations to keep pace with modern mass production methods. Experience in handling every metal piece, from small watch parts to Diesel engine crank cases, has given Blakeslee engineers the "know how" to solve your particular cleaning problems.

A qualified Blakeslee representative is located near your plant. Write, wire or phone and he will be pleased to discuss your cleaning problems with you.



G. S. BLAKESLEE & CO.

BLACOSOLV
DEGREASERS AND SOLVENT

NIAGARA
METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Geller New Sales Manager For Amercraft

Amercraft Products, Inc., 1024 South California Ave., Chicago, manufacturers of buffs, polishing wheels and anode bags, announce the appointment of *Albert C. Geller* as its sales manager. Mr. Geller has been associated with the manufacture and sale of wheels for polishing, buffing and abrasive purposes for more than 15 years, and is widely known in the metal finishing industry in the Middle West. His sales organization, with headquarters in Chicago, will include *John French*, of Rockford, Ill.; *Oscar F. Patzke*, of Milwaukee, Wis., and *Jack Goory*, of Cleveland, O.

South Florida Test Service Expands Facilities

The South Florida Test Service, of 4201 N. W. 7th St., Miami, Fla., announces the acquisition of an additional city block for the expansion of their inland proving grounds and plans for the erection of a new $25,000 laboratory building. Construction is to start early this summer. The company will celebrate its 20th anniversary in 1951.

South Florida Test Service specializes in weathering, corrosion and sunlight tests utilizing the unique climatological conditions found only in subtropical southeastern Florida, but has laboratory facilities for many types of special research and test work.

South Florida Test Service maintains a complete weather station at their inland proving grounds as well as complete solar radiation recording instru-

mentation. The company now maintains three locations in South Florida in addition to the main inland test field and laboratory in Miami. These locations at Miami Beach are for salt atmospheric tests and marine tests such as tidewater and total immersion in the ocean. A warehouse is also maintained in Miami for storage tests on packaging of foods, metal parts, etc.

Breithart to Represent Wagner Bros.

Wagner Brothers, Inc., 400 *Midland, Detroit* 3, *Mich.*, manufacturers and suppliers of polishing and plating materials and equipment, has announced the appointment of *H. J. "Dick" Breithart* as District Sales Manager, Buffing and Polishing Products. He will also handle sales of the company's other products, Wagner-Tiedeman rectifiers, "Lectrocop" and "Flat-Top" copper anodes, "Wabrite" and "Iso-Cast" cadmium, zinc and tin anodes and the new automatic buffing and polishing compound applying devices known as the "Appli-matic" and the "Spray-matic."

"Dick" Breithart is well-known to the metal finishing industries through his past activities as Sales Manager of

H. J. Breithart

Bruce Products from 1926 to 1942, and later as Western Manager of Divine Brothers. Recently, until his association with Wagner Brothers, Inc., he was Vice-President of Yerges Manufacturing Co., manufacturers of polishing and buffing wheels.

Udylite Appointed Tank Magnet Distributors

Appointment of the *Udylite Corp.*, Detroit, as national distributor for Rotary Tank Magnetools is announced by *Multifinish Manufacturing Co.*, 2114 *Monroe Avenue, Dept.* 468, *Detroit* 7, *Mich.*, the manufacturers.

As a feature of Udylite's initial sales program for these products the new D-Series Tank Magnetools, with a number of improvements, will be offered to the trade. These improvements include: increased capacity, stronger and more durable Neoprene wheels, a better wiper ring, and a stronger frame assembly. Other advantages stressed by the manufacturer are that the Magnetool cannot attach itself to the tank, will not injure tank lining, unloads instantly, is of stainless steel and Neoprene construction throughout.

National Technical Laboratories Increases New York Staff

National Technical Laboratories, manufacturers of Beckman Instruments, has announced the addition of *Mr. George D. Butler* to the company's New York office.

As a physicist in Instrumentation Research at the Calco Chemical Division of American Cyanamid Company, Mr. Butler has had considerable ex-

FIDELITY

DAVIS-K *Karat Gold*
PLATING SOLUTIONS
will strike a responsive chord!

Yes, constant users sing their praises. Try them—their ease of handling and economy will amaze you! Remember, all Davis-K Products are truly tried and proven, and designed for you—the plater. Made from U. S. Gov't Treasury Gold and the highest quality (C. P.) chemicals obtainable—plus our many years of experience, produce for you a "color-constant", tarnish-resistant and stable plating solution. Davis-K are distributors of Bakers' lustrous RHODIUM Solutions, that produce a long-lasting white finish.

We are at your service and welcome the opportunity to solve your gold plating problems. We will plate your samples in any color desired at no charge. Call or write today!

"Where Glittering Elegance Reflects Lasting Quality."

DAVIS-K PRODUCTS CO.

54 West 22nd St. ORegon 5-0094-5 New York 10, N. Y.

George D. Butler

perience, both in the development and use of pH Meters, Spectrophotometers and related scientific instruments. Mr. Butler also was an Engineer for Carl L. Norden Company during the war, and previously was with Bendix Aviation as a Technical Representative.

The addition of Mr. Butler to its New York office staff is another step in National Technical Laboratories' program of providing constantly expanding service facilities to keep pace with the steadily increasing number of Beckman Instrument users. The company also has complete service offices in Chicago and Los Angeles, thus providing convenient factory service from coast to coast.

Rapid Electric Engages Consultants To Handle Plating Problems

Rapid Electric Co., 2847 Middletown Rd., Bronx 61, N. Y., manufacturers of a complete line of selenium rectifiers and P.R. units, announce that they have retained the consulting services of *Henry Levine & Son, Inc.*, a long established and well known firm of metal finishing consultants.

This association will enable the Rapid Electric Co. to offer a consulting service to its customers, assisting them in specifying the proper rectifier or periodic reverse unit to do the job most efficiently. There will be no charge for this service; it is merely another step taken by Rapid Electric to further its policy of custom engineered equipment at regular prices.

3M Distributes Profit Sharing Checks to Employees

More than 6,300 employes of the *Minnesota Mining & Manufacturing*

CHEMCLEAN BREVITIES

Facts Without Frills

BURNISH-ALL

Burnishes any metal—all metals—ferrous—non-ferrous—precious.

Self-rolling or with burnishing compound.

High lustre—minimum time.

Not critical—easy to use—efficient in any type equipment.

***Inexpensive*—low operating cost.**

That's the Story

Price in 350 lb. barrels, 18c per lb.

***Send for a trial lot*—40 lbs. at 25c per lb.**

(Prices f.o.b. plant.)

CHEMCLEAN PRODUCTS CORP.

Manufacturers of Industrial Cleaners, Strippers and Chemical Specialties.

Dept. M-AP
64 Avenue of the Americas
New York 13, N. Y.

THE PLATING PRODUCTS CO.

EQUIPMENT & SUPPLIES For PLATING & POLISHING

NEWARK, N.J.

Complete Engineering Service for your Plating and Polishing Room

Office and Warehouse
352 MULBERRY STREET NEWARK 2, N. J.

Co. received checks recently for a share of the firm's profits in the fourth quarter of 1949.

A total of $293,484 was distributed to employes at 28 plants and offices in 15 states. About 4,100 of those affected work at the main plant and offices here. Yesterday's payment brought the total profit sharing distribution for 1949 to $943,108. It was the 52nd consecutive quarterly payment made by the company under provisions of its general profit sharing plan. The program is in effect for all permanent employes not participating in any other form of extra compensation.

Employe dividend payments are based on individual earnings for the quarter. Those with more than 30 months' service received checks Thursday for 7.2 per cent of their total regular and overtime income for the last three months of 1949. Shorter-term workers received amounts based on their length of service.

Perry Sloane Joins M. E. Baker Co.

A recent addition to the sales force of the *M. E. Baker Co.*, of Cambridge, Mass., is *Mr. Perry Sloane*. Mr. Sloane is a graduate of Columbia Univ. and has had wide experience in the plating field. He has served as finishing foreman of the Oakville Div. of the Scovill Mfg. Co., and for four years as chief chemist of the Benrus Watch Co. in Waterbury. He has also conducted a private consulting practice in the electroplating field. Mr. Sloane will cover Rhode Island and Mass. for the Baker Co.

Perry Sloane

Buckingham Products Appoints New Sales Representative

Mr. R. M. Buckingham, President of the Buckingham Products Company, announces the appointment of *Mr. R. O. Blackford*, 1336 Calvin, S. E., Grand Rapids, Michigan., as their Sales Representative for its polishing and buffing compositions and foundry supplies in the Grand Rapids district.

Almco Supersheen Establishes New Barrel Finishing Development Service

The recently enlarged Engineering and Development Dept. of *Almco Supersheen, Albert Lea, Minn.*, has added a new service for the purpose of solving special barrel finishing problems for manufacturers. This special service, in most instances done without charge, includes not only the special development of finishing procedure and technique but also special research and development on automatic handling, automatic separating, hoisting, etc.

Mr. R. C. Trow, General Manager,

True
INSULATOR

Protect your plating tank. Stop corrosion of coils and tanks. Reduce rejects due to stray currents. Plate the work in your tank not your boiler and water lines.

Install True INSULATORS today on all your steam and water lines where ever you have current. Save your maintenance man's time by these easy to install, long life True INSULATORS.

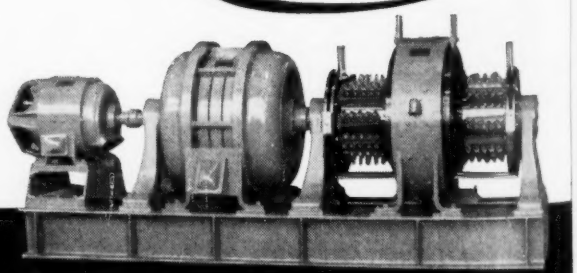
Available in several sizes.
$6.50 per pair for ¾ in. sizes. Other sizes proportionately priced. Discounts on quantities.

Write for Bulletin or Send Your Order

True Brite
CHEMICAL PRODUCTS CO.
P.O. BOX 31, OAKVILLE, CONN.

PRACTICAL PRODUCTS BY PRACTICAL PEOPLE

Motor Generators
by COLUMBIA



For
Electroplating — Anodizing
Electrocleaning — Electropolishing
There's a Columbia M-G Set available for your needs, whether you have a small plating bath or a large continuous strip plating line. Capacities up to 20,000 Amperes; 6 Volts and up. Dependable, performance proved, for many years. Your inquiries solicited.

Write today for Catalog MF-700
COLUMBIA ELECTRIC MFG. CO.
4529 HAMILTON AVENUE CLEVELAND 14, OHIO

in making this announcement states that this service is available to all manufacturers. Letters of inquiry are invited and, wherever possible, the manufacturer is requested to outline his problems whether it be finishing, handling or separating. In the event it is necessary, Almco will place a qualified enginer at the disposal of the manufacturer for an on-the-spot analysis of the problem.

Gallagher New Ass't Sales Manager for Munray Products

William A. Munkacsy, president of *Munray Products, Inc.*, 12400 Crossburn Ave., Cleveland, Ohio, announced the appointment of *Thomas P. Gallagher* as Assistant Sales Manager.

Mr. Gallagher, who was formerly associated with the Atlas Engineering Company, will assist *Ray W. Grace*, vice-president of Munray Products, Inc., in a sales expansion program.

Mr. Gallagher is a graduate of Culver Military Academy and attended Brown University and Kenyon College, where he majored in biology and chemistry. He was a Second Lieutenant in World War 2, and served as a navigator in the R.C.A.F. and A.A.F.

Munray Products Co. sells corrosion resistant materials and equipment; organic coatings; industrial finishes; adhesives; process equipment linings; moldings, and extruded products, manufactured by *The Poly-Cyclo Products Co.* manufacturing division.

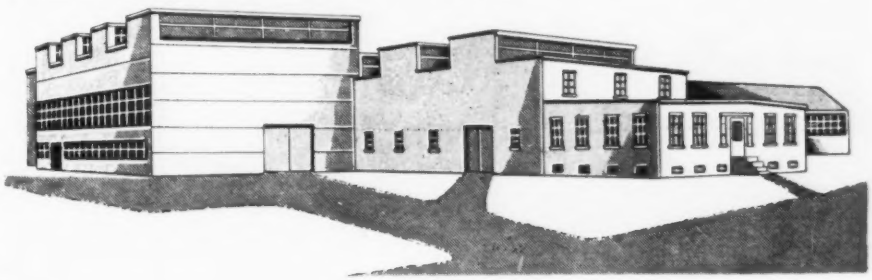
Metalwash Opens New Plant

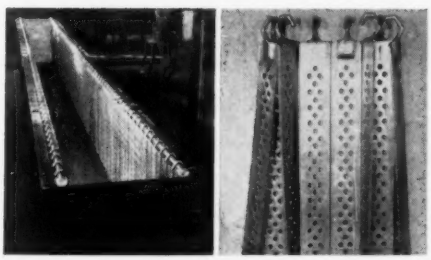
Metalwash Machinery Corp., formerly of 149 Shaw Avenue, Irvington, N. J., announces the opening of its new plant conveniently located on U. S. Route 1 at *North Avenue* in *Elizabeth, N. J.*

This new plant, located on a 4½ acre tract, is served by all means of transportation, being alongside Newark Airport and convenient to the Newark railroad stations. In addition, the highway location provides easy access by automobile.

The manufacturing area of more than 30,000 square feet is served by traveling cranes with capacities up to 35 tons, as well as railroad sidings. New machinery has been installed to provide better and more economical manufacture. These improved facilities will enable the corporation to produce its industrial washing machines, dryers, pickling machines, quench tanks and draw furnaces, bakery pan and rack washing machines, pot washers, and special machinery at an increasing rate to satisfy customer demands.

The plant has a two-story air conditioned office building containing executive offices, as well as purchasing, sales, engineering, and accounting departments.





More utility per dollar in

STORTS ANODES

STORTS Perforated Anodes—steel for cleaning and lead for plating—provide dozens of edges to act as distributing points for the current, are ruggedly built, handle easily and clean easily. They come fitted with a wide range of anode hooks for various requirements. For special jobs we make anodes to order—to go around, inside or below your work. Write for quotations on your current anode needs.

STORTS WELDING COMPANY INCORPORATED

42 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

INTIMATELY CONNECTED

So too-are your cleaning problems connected with your choice of buffing compounds.
SOLUBAR BUFFING COMPOUNDS give better cleaning along with top notch cut and color results.

APLEY N. AUSTIN COMPANY
BUFFING COMPOUNDS. INDUSTRIAL METAL CLEANERS
PLANT: PEQUABUCK, CONNECTICUT
SALES OFFICE: 75 FEDERAL STREET, BOSTON 10, MASS.

Porter-Cable Awards Diplomas to Trainees

The *Porter-Cable Machine Co., Syracuse, N. Y.*, recently began to award "sheepskins" to new field representatives who complete their course of instruction in the firm's Sales Training School. The men receive the degrees of M. G. (Master of Guild Tools) and D. S. (Doctor of Speedmatics).

Porter-Cable manufactures portable electric tools which are sold under the trade names "Guild" and "Speedmatic."

Recent graduates include: *N. B. Leydorf, Pierce McConaughy, H. F. Smith, Neil S. Rowe, John R. Perkins, V. C. Wheless, Robert Ingraham*, Sales Training Instructor, and *J. J. Howe*.

Minnesota Mining to Build New Office Building

Plans for the construction of a $3,000,000 office building were announced recently by *R. P. Carlton*, president of The Minnesota Mining & Manufacturing Co.

The new unit will relieve congestion in the present main office building, permit consolidation of other scattered office groups, and allow for future expansion.

Another part of the firm's nationwide expansion program is a two-story, block-long manufacturing plant now under construction here. It is scheduled for completion next fall and will cost more than $2,000,000.

The new structure will be adjacent

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to the present three-level administration building, and the first three levels of each will connect.

C. P. Pesek, the company's vice president in charge of engineering, said, "We hope to begin construction within 60 days and have the building ready for partial occupancy by Jan. 1, 1951." It should be completed by the summer of 1951, he added.

The building is designed for seven floors and a full basement, although Pesek said only five floors and basement will be built for the present. East and west walls will be windowless to prevent glare and heat from the summer sun. Sun shades will project over windows on the south wall as further protection. The structure will be of reinforced concrete and masonry with a brick and stone exterior, will be fully air conditioned and equipped with fluorescent lights throughout. A cafeteria is included in the plans.

Manufacturers' Literature

Rotary Automatic Buffing Machines

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

This firm announces release of a catalog describing the new Super Model K-46-6 indexing Rotary Automatic Finishing Machines, which claim the world's fastest indexing, variable work spindle speeds, and variable dwell time. The new Model K series machines have been designed to handle comparatively large work, such as small frames for automobile instrument panels, automotive accessories, builders' hardware, plumbing fixtures, electric appliances, household appliances, utensils, pots and pans, as well as many different finishing operations on plastics. The Catalog also describes the smaller J Series indexing and continuous Rotaries, Strait-line Automatics and various types of abrasive belt and wheel type heads, suitable for a widely diversified number of grind-

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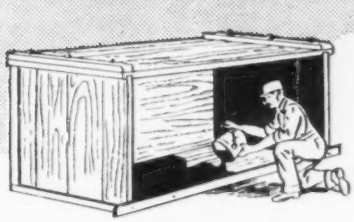

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Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

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ing, polishing, buffing or deburring operations.

Price List of Gold Plating Salts

Bart-Messing Corp., Dept MF, 45 Morgan Ave., Brooklyn 6, N. Y.

This firm has recently published a price list for their line of gold plating salts and prepared solutions. In addition, technical data is given on the proper operation of Sel-Rex gold plating baths. In addition to gold salts and solutions, the firm also carries a line of rhodium and silver plating needs, as well as a complete line of plating rectifiers and equipment.

Buffing, Grinding, Polishing Machines

The Hisey-Wolf Machine Co., Dept. MF, Cincinnati, O.

A new catalogue just issued by this firm illustrates and describes a full line of equipment for grinding, buffing, and polishing operations. Bench and pedestal types of machines, dust filters and exhausters, and a wide variety of auxiliary equipment are described. Polishing lathes up to 15 H.P. are included in the line, with variable speed and large overhang machines featured.

Demineralized Water

Barnstead Still & Sterilizer Co., Inc., Dept. MF, 223 Lanesville Terrace, Forest Hills, Boston 31, Mass.

This firm has issued a new comprehensive catalog which describes in detail the difference between distilled and demineralized water. This 20-page catalog highlights the advantages of either distilled water or demineralized water as used in manufacturing and processing operations which call for pure water. It answers the question "What is the difference between distilled and demineralized water?"

It also cites case histories on quality control of water that have resulted in better products, uniform results, fewer rejects, and the reduction of costs in plant operations. It shows how ion-exchange purification works with the catalog containing more than 30 illustrations.

The manufacturer offers to send Catalog 123 to anyone interested in pure water and states that the Barnstead Engineering Dept., will be glad to make recommendations on equipment for special applications.

Arrest and Control of Rust

International Rustproof Corp., Dept. MF, 12507 Plover Ave., Cleveland, O.

For field and maintenance men in the light and power industry, a new 6-page engineering data sheet is being released this month by *International Rustproof Corp.* Entitled "Field Information on the Arrest and Control of Rust," it deals in a highly informative manner with a subject that is of vital interest to the power transmission and utility industries.

The report, while based upon the findings of years of intensive study by engineers and technical specialists, is presented in layman's language, clearly illustrating and describing the causes, effect and proper means for control of rust. It is pointed out that application of this knowledge can save industry millions of dollars annually.

Attractively bound for use as a permanent reference work, the report is available on request.

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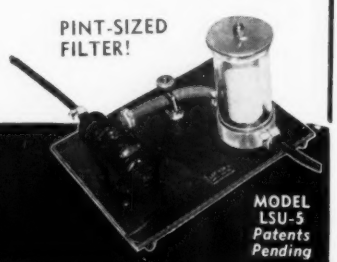

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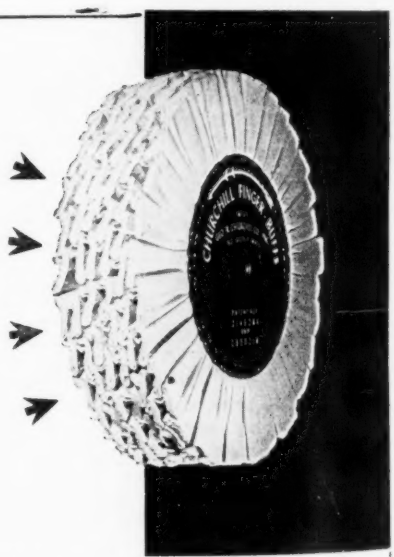

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Dust Collectors

Hammond Machinery Builders, Dept. MF. 1639 Douglas Ave., Kalamazoo, Mich.

Two bulletins recently issued by this firm describe their line of dust collectors for use with grinders, polishing and buffing lathes, or any other equipment where the collection of the dust is important. Bulletin 20 gives details of their cyclone type units, in sizes from 250-750 c.f.m. Bulletin 19 gives specifications on self-contained Duskolectors of 330-1000 c.f.m. The latter units are mounted directly back of the polishing machine and require a minimum of installation.

Copies of these circulars are available on request.

Corrosion Resistant Coatings

Atlas Mineral Products Co., Dept. MF, 41 Walnut St., Mertztown, Pa.

The above firm announces a new Bulletin 7-1 on "Protective Coatings for Industry." This Bulletin contains information on coatings suitable for protection against corrosive fumes or splash on steel, concrete, and wood surfaces. A card addressed to this address will bring this new Bulletin by return mail.

Corrosion Resistant Equipment

Maurice A. Knight, Dept MF, Kelly Ave., Akron 9, O.

The above firm has recently issued new bulletins describing their line of Permanite materials and equipment for handling strongly corrosive chemicals. One bulletin describes completely molded items such as tanks, absorption towers, kettles, and pans. Another details their line of pipe and fume ducts, with engineering data and properties. A third gives details on their acid-proof cements for floor construction where extreme wear and corrosion resistance must be considered. Copies of any of these bulletins are available by writing to the above address.

Buffing and Polishing Equipment

United States Electrical Tool Co., Dept. MF, Cincinnati, Ohio.

This firm has recently issued a booklet describing a line of hand grinders and sanders, as well as a complete line of buffing and polishing machines, in sizes from 2-20 H.P. A wide variety of types is offered, including extended spindles, variable speed, and dual spindle machines. Bench and floor models, dust collectors, swing grinders, and a host of auxiliary equipment are also pictured and detailed. Copies are available at the above address.

Chromium Chemicals Handbook

Diamond Alkali Co., Dept. MF, 300 Union Commerce Bldg., Cleveland 14, O.

A fact-filled, 32-page handbook on chromium chemicals, clearly depicting their general use and diversified applications in more than 17 different industries, has just been prepared by the above firm for chemists, metallurgists, engineers, production managers, purchasing directors and other interested executives.

Among the applications cited in which this specialized Diamond chemical is advantageously employed are its utilization as a mordant for wool and to improve color fastness; as a "red dip" for brass and other copper-base alloys following annealing, and

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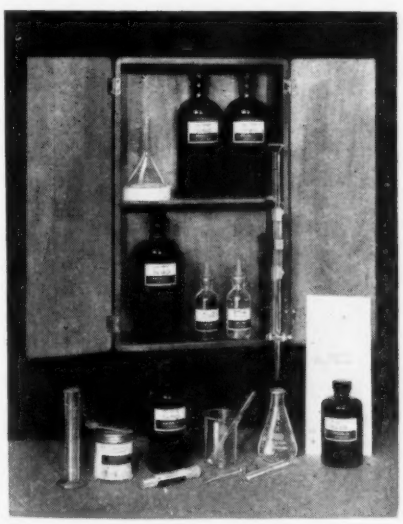

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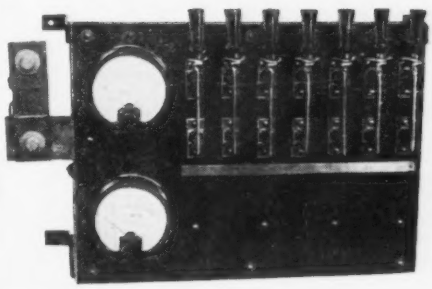

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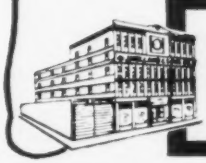

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as a corrosion-resistant treatment of magnesium, tin plate and aluminum: as a means of inhibiting corrosion in water-cooled or water-circulating equipment, and as an anti-corrosive additive in oil well drilling and gas condensate wells.

Similar information is also given for Diamond sodium chromate and bichromate of potash. In addition, the booklet discusses six methods of analyzing sodium bichromate. Supplementing this information are helpful charts and tables covering equivalent weights, conversion formulas, tank capacities and graphical data.

New Method of Tank Heating and Cooling Explained

Kold-Hold Mfg. Co., Dept. MF, Lansing, Mich.

Tank heating and cooling is vividly described and illustrated in a new six-page bulletin just released by the above firm. A direct comparison is made between the Platecoil and pipe coil methods of heat exchange. The bulletin shows how Platecoil takes only half the tank space, yet heats faster than pipe coil. The ten advantages of Platecoil are described in relation to savings in time, money and manpower for the user. Copies of the Bulletin may be secured by writing.

News from California

Recently elected to the presidency of the Los Angeles Branch of the A.E.S. was *Mr. Richard J. Wooley*, who is the Pacific Coast Manager for *United Chromium, Inc.* At the same time he was also chosen as a delegate to the Boston Convention in June of this year.

Richard J. Wooley

Morey Plating Co., 2972 *East Century Blvd., Lynwood, Calif.*, on March 1 changed name to *Surface Alloys, Inc.* No change in executives or personnel was involved. The firm is headed by *C. J. Coberly, Jr.*, president; *C. J. Coberly, Sr.*, treasurer, and *O. T. Burns*, secretary.

The company operates a 6,000 square foot job shop at 2972 East Century Blvd., in Lynwood, and a second plant at 3040 E. Slauson Ave., Huntington Park. This latter plant contains about 4,000 square feet of floor area and is equipped for specializing in oil-well tool finishing. There, too, is located the firm's research laboratory, with *Morton Schwartz* as chief chemist and *Francis O'Dell* as assistant.

The number of women occupying important research posts in the metals and metal finishing industries in Southern California is steadily increasing. At the Turbodyne Corp.

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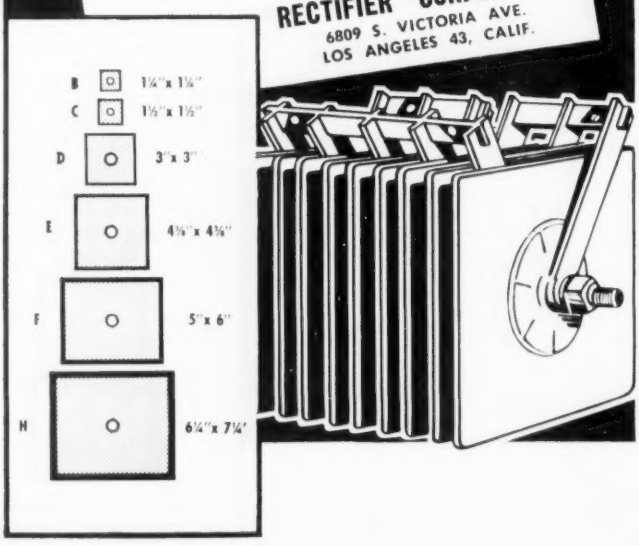
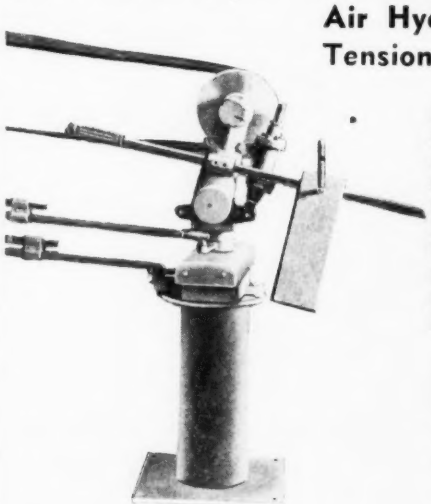


The NIEDERST COMPANY
Manufacturers of Back Stand Idlers designed for faster-smoother polishing plus versatility. Now available with Air Hydraulic Belt Tension Control.



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Write for Specification Sheet and information for introducing belt polishing on your present lathe equipment.

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plant in Hawthorne, Calif., the name on the laboratory doors reads "R. H. Smith, chief metallurgist." The executive behind the door is *Mrs. Rebecca Hall Smith.*

Mrs. Smith (in private life, Mrs. Joseph Sparling), is one of the few top-ranking metallurgists in the country. She also heads the Turbodyine Corporation's materials and process division. Her work in the analysis of heat shading of metals has been especially significant. At present, titanium is her pet subject. She predicts an expanding future for that metal in the aircraft industry.

Mrs. Smith feels there is a great future in metallurgy and kindred lines of chemical and analytical research for women.

Plant Expansions

Fred J. Russell, general manager of the *Weiser Mfg. Co.*, South Gate, Calif., reports the firm is erecting a plant addition across the street from its main plant at 8626 Otis St., for increased production of lock sets.

Reynolds Metals Co. has completed a new 20,000 square foot plant in Vernon, Calif., for aluminum foil processing.

Connor Spring Mfg. Co. has doubled its floor area at 3700 So. Main St., Los Angeles, and has added considerable additional production machinery.

NEW BOOKS

The Story of Magnesium

By W. H. Gross. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio. Price $2.00.

This 260-page book is written primarily for the non-technical person who has not been trained in engineering or metallurgy. It traces the history and development of the metal, and describes its important uses and properties in a language easy to understand. While the method of presentation is simple and direct, the factual accuracy of the subject matter is of the highest order, and the numerous questions at the end of each chapter make the book especially convenient as a teaching text. Subjects covered are Production; Alloying, Melting and Refining; Casting; Fabrication; Machining; Joining; Surface Finishing (does not include anything on plated coatings); Metallurgy of Magnesium, and Uses.

Transactions of the Electrochemical Society—Vol. 94

Published by the Electrochemical Society, 235 W. 102 St., N. Y. C.

A bound volume of the technical papers presented before the Society meetings during 1948. Papers of interest to electrochemists in the plating field include the following:

Coating Steel with Nickel by Immersion in Nickel Chloride Solutions —W. A. Wesley and H. R. Copson.

Electrolytic Reduction of Aqueous Tungstate Solutions—M. L. Holt and L. E. Vaaler.

Electrodeposition of Gamma Manganese—D. Schlain & J. D. Prater.

Electrodeposition and Properties of Tin-Zinc Alloys—J. W. Cuthbertson & R. M. Angles.

Lead Refining with Sulfamate Baths—R. Piontelli.

Electrowinning Manganese from Chloride Baths—
J. H. Jacobs & P. E. Churchward.

Deposition of Nickel from Orthophosphate Baths—C. B. F. Young & E. S. Roszkowski.

Measuring the Permeability of Anodic Films on Aluminum—R. L. Burwell & T. P. May.

Electrodeposition of Cobalt-Tungsten

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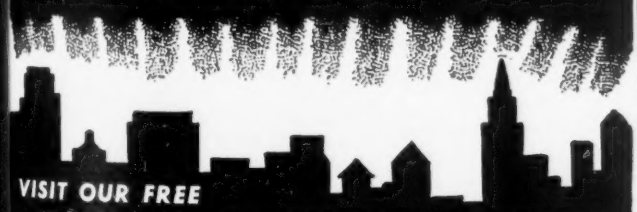

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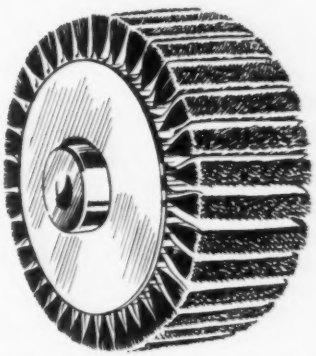

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Alloys from a Citrate Bath—W. E. Clark & M. L. Holt.

Effect of Pressure on the Current Efficiency in Copper Deposition from Cyanide baths—R. E. Webb & H. B. Linford.

Electrodeposition of Synthetic Resins—C. G. Fink & M. Feinleib.

Effect of Ionic Addition Agents on Polarization in Copper Plating—T. B. Lloyd, M. R. Lauver & F. Hovorka.

Oxygen Efficiency in Anodic Oxidation of Aluminum—J. Kronsbein.

The discussion following the presentation of the above papers are also included in this volume.

A.S.T.M. Metal Cleaning Bibliographical Abstracts (1893-1949)

Prepared by Jay C. Harris. American Society for Testing Materials, 1916 *Race St., Philadelphia* 3, *Pa.,* $2.75 *each.*

This 1949 book (Special Technical Publication No. 90) makes available in compact form a tremendous amount of information on the subject which should be of widespread interest to all those concerned with metals and their surfaces and cleaning.

The publication has been made possible by the intensive efforts of *Jay C. Harris,* Monsanto Chemical Co., who is now the Secretary of A.S.T.M. Committee D-12 on Soaps and Other Detergents. The task of organizing the data concerning metal cleaning was initiated by Mr. Harris and *Robert B. Mears,* Carnegie-Illinois Steel Corp., in 1943, the early work being concentrated on aluminum cleaning. Subsequent issues of Annotated Bibliography of Aluminum Cleaning were made and eventually other metal cleaning work was covered and supplements were issued. With interest in the subject definitely on the increase, it was felt a more systematic treatment was desirable and Mr. Harris has consolidated all the previous material, added a large group of additional references, and prepared four helpful indexes: Subject, Author, Specification, and Patent.

The references are arranged first by year and then by author, and they are numbered consecutively with specific numbering sequence. There are almost 500 references and abstracts. As far

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1.0-2.8	11.0-13.1
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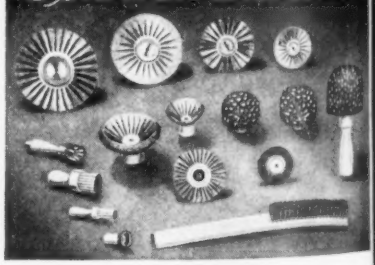

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as possible original articles have been abstracted, but some material is reabstracted from other journals.

Obituaries

CHESTER MORGAN CAMPBELL

We announce, with regret, the passing of Mr. Chester Morgan Campbell, retired chemist and plating foreman of the Crane Company, Chicago. Mr. Campbell graduated from the University of Illinois, and for the past twenty years worked for the Crane Company as chemist and foreman of the plating department. Mr. Campbell was 54 years old at the time of his death. Surviving are two sons, C. W. Campbell and R. L. Campbell, as well as a daughter, Mrs. Robert Anderson, and the widow, Mrs. Louise Campbell.

R. H. RUENZEL

It is with sincere regret that we report the death of Mr. R. H. Ruenzel, late president of Ardco, Inc., Chicago, Ill., who passed away on Feb. 20th.

Mr. Ruenzel had been associated with the plating and polishing industry for approximately 30 years in an executive capacity. He had been president of Ardco, Inc., since its inception approximately 5 years ago. Prior to that he had been associated in an executive capacity with a buffing compound manufacturing concern located in the middle west.

RICHARD H. ALDEN

Richard H. "Dick" Alden, for several years a sales representative with Frederic B. Stevens, Inc., of Detroit, died at Toledo, Ohio, on February 14, 1950, after a brief illness.

Mr. Alden represented the Stevens organization principally through the western part of Michigan where he had many friends in the plating and polishing industry. He was a very active member of the American Electroplaters Society.

Mr. Alden is survived by his widow and three sons.

ARTHUR E. GIBBS

Arthur E. Gibbs of Wayne, Pa., died after a brief illness at Summerville, S. C., on March 2nd. He was 74 years old. Graduated from Bristol University (England) in Chemical Engineering, he joined the Pennsylvania Salt Mfg. Co. at its plant at Wyandotte, Mich., where he invented and developed the Gibbs cell for the electrolytic production of chlorine, caustic soda and hydrogen from common salt brine. The Gibbs cell has since become an important factor in the production of these chemicals in the United States and foreign countries, and it is for this that he is most widely known in the field of electrochemistry.

In 1908, Mr. Gibbs organized the first separate Research and Development Department of Pennsalt. He continued as head of this Pennsalt activity, and later as Advisory Technical Director until his retirement in 1946.

He traveled widely and was a friend of many chemical leaders in America and Europe. One of his chief interests in life was the assisting of younger men in the development of their scientific and industrial careers.

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